Michigan Technological University

Undergraduate Course Descriptions
Effective Fall 2025

Accounting

ACC 2000 - Accounting Principles I

Introduction to basic principles, concepts, and theoretical framework of financial accounting with the emphasis on its use by economically rational decision makers. Topics include the decision-making environment and the accounting cycles, processes, and statements.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring

ACC 2100 - Accounting Principles II

Emphasizes the role of accounting information within a firm. Topics include budgeting, responsibility accounting, cost allocations, cost behavior, decision models, capital budgeting, and an introduction to product costing in manufacturing and service sector firms.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): ACC 2000

ACC 3000 - Intermediate Accounting I

Studies the theory, concepts, and practices underlying financial reporting and measurement. Primary focus is on income measurement, and the valuation of assets, like cash, receivables, inventory, and long-lived assets, as well as multinational issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): ACC 2000

ACC 3100 - Intermediate Accounting II

A continuation of ACC 3000 with theories, concepts, and practices underlying financial measurement and reporting. Focuses on the measurement and reporting of liabilities and equities, and includes multinational issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): ACC 3000 and FIN 3000(C)

ACC 3500 - Managerial/Cost Accounting I

The primary emphasis is on traditional and contemporary product costing techniques, cost allocation practices, and basic cost-management issues. Topics include process costing, standard costing, activity-based costing, backflush costing, cost allocation issues, balanced scorecard, strategic profitability analysis, and the role of accounting in contemporary management practices.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): ACC 2100

ACC 3600 - Foundations of Taxation

Introduction to basic principles, concepts, and theoretical framework of taxation systems, emphasizing income taxation and its impact on decision making. Topics include tax planning and compliance for individuals, corporations, and partnerships.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): ACC 2000

ACC 4000 - Accounting Data Analytics

Develop knowledge and competencies in data analytic techniques to generate accounting information used for business intelligence. Applied exercises with software tools are used to cover topics including data preparation, analysis, visualization, and scenario analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): ACC 2000 and ACC 3000(C)

ACC 4100 - Audit and Assurance

Auditing procedures and techniques associated with public accounting and with internal auditing for business entities. Topics include auditor's responsibilities, professional ethics, generally accepted auditing standards, purpose and types of audits, objectives, internal control, evidence, organization within the public accounting profession, the audit program, and auditing procedures and techniques.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): ACC 3000 or ACC 5050

ACC 4200 - Advanced Accounting

The theory and practice of financial accounting and reporting pertaining to business combinations and consolidated financial statements, foreign operations, and complex financial instruments statement translations, and other advanced accounting topics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): ACC 3100

ACC 4500 - Managerial/Cost Accounting II

Emphasizes information requirements of contemporary management decision-making and strategic-planning processes. Covers contemporary control and evaluation practices (such as activity-based management), determining the costs of quality, and productivity analysis in the context of accounting information systems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): ACC 3500

ACC 4600 - Advanced Tax Topics

Continuation of ACC3600. Introduction to advanced principles and concepts of taxation, emphasizing income taxation and its impact on decision making. Topics include tax planning and compliance for estates and trusts, gratuitous transfers, multi-jurisdictional operations, and entity formations, liquidations, and reorganizations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): ACC 3600

ACC 4700 - Governmental and Not-for-Profit Accounting

An in-depth study of the accounting principles and financial reporting unique to the governmental and not-for-profit sectors of the U.S. economy.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): ACC 3000

ACC 4800 - Accounting Systems

Introduction to the basic principles, concepts, and theoretical framework for the design and operation of accounting information systems, emphasizing its use to enhance decision making. Topics include system design, internal controls, the use of databases, and electronic commerce.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): ACC 2100 or ACC 5050

ACC 4990 - Special Topics in Accounting

Examines current issues in Accounting and other topics of interest to faculty and students in greater depth.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): ACC 3000

Aerospace Engineering

AE 2500 - Principles of Aerospace Engineering

Introductory course covering the principles of aerospace engineering. Topics include principles of flight, rocketry and propulsion, space mechanics, aerospace materials, introduction to jet engines, basics of space environment and thermal management in space.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): ENG 1102

AE 2550 - Space Environment & Operation

Introductory course on space environment and operations. Topics include, planetary and space environments, space mission operational aspects and consideration of space and planetary environment. Basics of spacecraft functionality and design considerations will be discussed in the various operational environments.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): ENG 1102 and PH 2200

AE 3501 - Aerospace Systems Engineering Practice

This course will introduce Aerospace Systems Engineering. Topics covered include requirement flow-down, validation and verification methods, operations, FMEA, risk mapping, interface control definitions, design reviews, project phases and life cycle, documentation, traceability and application of standards.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): ME 2150 and ME 2700 and ME 2911(C) and AE 2500 and AE 2550

AE 3511 - Spacecraft Engineering Practice

Students will learn processes and concepts necessary to design, build, and integrate spacecraft components into a vehicle while reinforcing fundamental mechanics, dynamics, and thermal concepts through laboratory testing based on Space industry standard testing processes, such as Test Like You Fly philosophy.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): AE 3501

AE 3520 - Aerodynamics

This course addresses the fluid dynamics of gases and convection heat transfer around the aircraft and through propulsion systems. Potential flow, boundary layer, characteristics of laminar and turbulent flows, wall friction, Reynolds analogy, convection heat transfer, and introductory discussion of aircraft dynamics, stability, and control.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): AE 2500 and MA 3160 and (ME 2911 or MEEM 2911)

AE 4530 - Compressible Flow

Fundamentals of one-dimensional gas dynamics, including flow in nozzles and diffusers, normal shocks, frictional flows, and flows with heat transfer or energy release; introduction to oblique shocks.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): AE 3520 or MEEM 3201 or ME 3201

AE 4540 - Aerospace Propulsion

Course covers principles of jet propulsion, cycle analysis and analysis of non-rotating components and turbomachinery. Also covered are principles of rocket propulsion, propellants, and electrified aircraft propulsion.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): (AE 3520 and AE 4530) or MEEM 3201 or ME 3201

AE 4550 - Spacecraft Thermal Engineering

This course covers fundamentals of heat transfer with applications to spacecraft thermal control. Heat transfer topics focus on steady and transient heat conductions (1D and 2D) as well as single and multiple surface radiation. Passive and active thermal control components along with simulation are used to demonstrate thermal management.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): AE 3520 and AE 3511

AE 4560 - Aerospace Materials & Structures

Course covers the mechanical behavior of materials and structures used in aeronautical and space vehicles. The fundamentals of lightweight alloys and composite materials will be covered, including failure and durability. Structural behavior of thin-walled structures, including torsion, warping, bending, and buckling will be covered.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): AE 2550 and (ME 2150 or MEEM 2150)

AE 4570 - Space Mechanics

This course presents the vector-based solution of the two-body problem and the solution for Kepler's equations. The course will also cover basic orbit determination techniques, impulsive orbit transfer maneuvers, interplanetary trajectories, ground tracks, and rendezvous problems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Aerospace Engineering
Pre-Requisite(s): MEEM 2700 or ME 2700

AE 4580 - Spacecraft Dynamics & Control (SD&C)

This course covers spacecraft kinematics, dynamics, stability and control including actuation and sensing techniques. Simulation-based analysis is introduced to illustrate concepts and connect theory to practice.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Aerospace Engineering
Pre-Requisite(s): AE 4570(C) and (MEEM 3750 or ME 3750)

Air Force ROTC

AF 1001 - US Air Force Heritage and Values I

Introduction to the USAF and ROTC. Topics include Air Force mission and organization, officership, professionalism, military customs and courtesies, officer opportunities, and communication skills. Leadership Laboratory is mandatory for AFROTC cadets and provides cadets with followership experiences.
Credits: 1.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall

AF 1002 - US Air Force Heritage and Values II

Introduces students to the USAF and ROTC. Topics include Air Force operations and installations, evolution of USAF, principles of war and tenets of Airpower, ethical decision making under pressure and what our Air Force 'brings to the fight'. Leadership lab is mandatory for AFROTC cadets and provides cadet with followership and leadership experiences.
Credits: 1.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Spring

AF 1120 - Physical Conditioning

Activities that promote physical conditioning. Emphasis is on individual conditioning through strength and aerobic training and team sports such as ultimate frisbee and football. May be used once as a general education co-curricular course. Sports physical required prior to start of class (contact instructor for details).
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

AF 1230 - Precision Drill Team

Techniques and skills involved in precision drill movements, including marching, rifle spinning, ceremonial saber handling, and color guard performance. Each student must have or purchase an appropriate drill-team uniform. Non-cadets are required to provide a uniform cleaning deposit and purchase some non-returnable uniform items.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

AF 1340 - Field Training

A rigorous program of physical conditioning, team activities, and survival training. Offered the summer semester after acceptance into the Field Training program. Course completed off campus.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Summer
Restrictions: Permission of instructor required
Pre-Requisite(s): AF 2002

AF 2001 - Team and Leadership Fundamentals I

Introduction to team building and leadership development. Topics include effective listening, followership, and problem solving and motivation techniques for creating a successful workplace.
Credits: 1.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall

AF 2002 - Team and Leadership Fundamentals II

Advanced concepts for developing team and leadership abilities. Topics include human relations, conflict management, stress management and resiliency and the importance of ethical decision making in the workplace.
Credits: 1.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Spring
Pre-Requisite(s): AF 2001

AF 3001 - Leading People and Effective Communication I

Study and practice of leadership in civilian and military organizations, with emphasis on development of effective oral and written communication. Topics include Air Force leader development, effective supervision, diversity, cross-cultural competence and ethics. The course includes discussion, informal lecture, case studies, self-evaluation of leadership traits, and experiential exercises.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015

AF 3002 - Leading People and Effective Communication II

Study of leadership in civilian and military institutions. Topics include leadership theory, mentoring, feedback, organizational climate, and professionalism. The course includes discussion, informal lecture, case studies, and experiential exercises.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

AF 4001 - National Security/Leadership Responsibilities/Commissioning Preparation I

This course is designed to develop an understanding of the nature of conflict and how the United States military forces are developed, organized, and employed. Topics include the need for national security, the evolution and formulation of American defense policy and strategy, the origins of regional security issues, cross cultural competence, and joint doctrine.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

AF 4002 - National Security/Leadership Responsibilities/Commissioning Preparation II

This course examines selected roles of the military in society, unconventional warfare, current issues affecting the military profession, and the military justice system. Special topics of interest focus on information warfare, the law of armed conflict, the military as a profession, and officership.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

Army ROTC

AR 1001 - Introduction to the Army and Critical Thinking

Introduces cadets to the competencies that are critical for effective leadership. Cadets learn how the personal development of "life skills" such as critical thinking, time management, goal setting, stress management, and comprehensive fitness relate to the Army profession.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall

AR 1003 - Leadership and Competence

Introduces Cadets to the competencies that are critical for adaptive leadership. Cadets learn the basics of the communication process and the importance of developing the essential skills to effectively communicate in the Army. Students will examine the Army profession in depth.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring

AR 1011 - Basic Leadership Lab I

Practicum in basic military topics such as drill and ceremony, emergency preparedness, survival skills, and military communication. This course will require 4 days, 3 nights training at Fort MCoy in late September.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall

AR 1012 - Basic Leadership Lab II

Practicum in basic military topics such as first aid, teambuilding, orienteering, profession of arms, and ethics in problem solving. This course will require 4 days, 3 nights, training at Fort MCoy in April and 1 Saturday in March.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring

AR 2001 - Leadership and Ethics

Explores the dimensions of creative tactical leadership styles by examining team dynamics and historical leadership theories that form the basis of the Army leadership framework. Aspects of motivation and team building are practiced through planning, executing, and assessing team exercises
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall

AR 2002 - Army Doctrine and Decision Making

Examines the challenges of leading teams in complex operational environments. The course highlights terrain analysis, patrolling, and operation orders. Cadets develop greater self-awareness as they assess their own leadership styles and practice communication and team building skills.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring

AR 2011 - Intermediate Leadership Lab I

Practicum in basic military topics, such as drill and ceremony, emergency preparedness, survival skills, and military communication. This course will require 4 days, 3 nights, training at Fort McCoy in late September.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall

AR 2012 - Intermediate Leadership Lab II

Practicum in basic military topics, such as first aid, teambuilding, orienteering, profession of arms, and ethics in problem solving. This course will require 4 days, 3 nights, training at Fort McCoy in April and 1 Saturday in March.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring

AR 2068 - Fall Military Physical Conditioning

Develops physical fitness, personal confidence, self-esteem and military skills. Students are exposed to both individual and group physical fitness procedures and techniques. Emphasis is on developing a good fitness program for each individual student.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Summer

AR 2069 - Spring Military Physical Conditioning

Develops physical fitness, personal confidence, self-esteem and military skills. Students are exposed to both individual and group physical fitness procedures and techniques. Emphasis is on developing a good fitness program for each individual student.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring

AR 3001 - Warfighting Functions

Teaches cadets to plan, coordinate, navigate, motivate, and lead a squad and platoon in the execution of mission during a classroom PE, a leadership lab, or during a leader training course.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall
Co-Requisite(s): AR 3011

AR 3002 - Leadership and Operations

Cadets will study, practice, and apply the fundamentals of Army leadership, officership, Army value and ethics, personal development, and small unit tactics at the platoon level.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Co-Requisite(s): AR 3012
Pre-Requisite(s): AR 3001

AR 3011 - Advanced Leadership Lab I

Practicum in basic military topics, such as drill and ceremony, emergency preparedness, survival skills, and military communication. This course will require 4 days, 3 nights, training at Fort McCoy in late September.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Co-Requisite(s): AR 3001

AR 3012 - Advanced Leadership Lab II

Practicum in basic military topics, such as first aid, teambuilding, orienteering, profession of arms, and ethics in problem solving. This course will require 4 days, 3 nights, training at Fort McCoy in April and 1 Saturday in March.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Co-Requisite(s): AR 3002
Pre-Requisite(s): AR 3011

AR 3068 - Military Physical Leadership I

Develops a cadet's leadership abilities to design, implement, and assess a platoon level Army physical training program. Cadets learn the basic leadership of designing and developing a physical conditioning program.
Credits: 1.0; Repeatable to a Max of 12; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): AR 2068 and AR 2069

AR 3069 - Military Physical Leadership II

Develops a cadet's leadership abilities to design, implement, and assess a platoon level Army physical training program. Cadets improve their small group's level of physical conditioning while honing their own leadership skills.
Credits: 1.0; Repeatable to a Max of 12; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): AR 3068

AR 4001 - Mission Command I and the Army Profession

Completes the Cadet to commissioned officer transition. Course stresses mission command and ethics to assist the Cadet in further embracing their role as an Army officer.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Co-Requisite(s): AR 4011
Pre-Requisite(s): AR 3001 and AR 3002

AR 4004 - Mission Command II and the Company Grade Officer

Course will teach critical knowledge, skills, abilities, and competencies that newly commissioned officers will need to succeed in their first unit of assignment. Cadets will examine the Army profession in depth.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Co-Requisite(s): AR 4012
Pre-Requisite(s): AR 3001 and AR 3002

AR 4011 - Battalion Staff Operations I

Develops personal confidence and advanced leadership ability using basic and advanced military skills. Students are given responsibility for planning and controlling the activities of the cadet battalion. Applied creativity, problem solving, decision making, and leadership are the cornerstones of this course. This course will require 4 days, 3 nights, training at Fort McCoy in late September.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Co-Requisite(s): AR 4001

AR 4012 - Battalion Staff Operations II

Develops personal confidence and advanced leadership ability using basic and advanced military skills. Students are given responsibility for planning and controlling the activities of the cadet battalion. Applied creativity, problem solving, decision making, and leadership are the cornerstones of this course. This course will require 4 days, 3 nights, training at Fort McCoy in April and 1 Saturday in March.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Co-Requisite(s): AR 4004

AR 4100 - Special Topics Leadership Development

Study and discussion of topics in Military Leadership not included in regular undergraduate courses. This course will require the support of one weekend training event up to 3 nights, 4 days, in length such as: Fall Field and Tactical Exercise, Ranger Challenge, or Super Lab.
Credits: 1.0; Repeatable to a Max of 2
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

AR 4200 - Leadership Development

Study and discussion of Military Leadership. This course will require the support of one weekend training event up to 3 nights, 4 days, in length such as: Spring Field and Tactical Exercise, Ranger Buddy, or Super Lab.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

Art

ART 1000 - Art Appreciation

Introduces students to analytical tools to critically observe the visual world. By studying arts media, artists and designers, creative and technical processes, principles of design, as well as major works of art, students will express their own ideas about the visual experience in written and visual form.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer

ART 1100 - Drawing I

Exploration of fundamental principles of drawing. Develop skills in representational drawing, perspective, and composition. Develop creative and modern drawing techniques using a wide range of subject matter. Presentations and discussions illustrate classic principles. Course encourages development of individual expression.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Summer

ART 1110 - Art + Design Studio

Introduction to art and design. Explores design principles and creative problem solving using multiple materials. Students also examine design's ability to shape and interpret information. Hands-on studio work, lectures, and discussions. Emphasizes creativity, inventiveness, and experimentation.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Senior

ART 1850 - Special Arts Activities for Wellness + Success

Essential Ed, arts wellness (topics vary). Students work on creative projects to support personal wellness. Examples include: weaving/fiber arts; craft workshops; singing; group music-making' community arts projects; special theatre projects.
Credits: 1.0; Repeatable to a Max of 3; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring, Summer

ART 1855 - Special Arts Workshop for Wellness + Success

Essential Ed arts wellness (topics vary). Students work on creative projects to support personal wellness. Examples include: weaving/fiber arts; craft workshops; singing; group music-making; community arts projects; special theatre projects.
Credits: 0.5; Repeatable to a Max of 3; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-.5)
Semesters Offered: Fall, Spring, Summer

ART 2100 - Drawing II

Observational and imaginative drawing including the human figure and abstraction techniques. Contemporary drawing systems, concepts, and processes. Emphasis is on proportion, structural framework, visual measurement, movement, and relationships. Students work in a variety of drawing media.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Pre-Requisite(s): ART 1100 or ART 1110 or ART 2130 or ART 2160 or ART 2190 or ART 2195 or ART 3130 or ART 3180 or ART 3190 or ART 4450

ART 2110 - Art on Site

Focused on making works of art "on location" - in forests, community centers, museums, theatres, and as special projects in unique spaces. Students explore different materials, and ask open-ended ideas about how art is made and what it can be.
Credits: 3.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring, in even years

ART 2140 - Ceramics I

Introduces hand building ceramic techniques, including coil, slab, pinch and wheel throwing. The goal is to allow students to be individually creative through experimenting with the possibilities in three-dimensional form. Historical, contemporary, functional and sculpture processes will be explored.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring, Summer

ART 2145 - Beginning Wheel Throwing

Students will learn the fundamental techniques of using a pottery wheel, as a tool, to shape clay into utilitarian and sculptural forms. Historical and contemporary practices will support each individuals' creative abilities.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring, Summer

ART 2170 - Fiber Arts

A foundation course in fiber art techniques, concepts, history, and theories. Conceptual development will be emphasized as students learn to use contemporary fiber techniques in their studio arts practice. Media covered includes sewing and embroidery, dyeing, felting, knitting and crocheting, printing, and soft sculpture.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ART 2195 - Art & Flora: Visual Taxonomies of Terrestrial & Aquatic Ecosystems

Immersive field trips to nature spaces and museums provide opportunities for basic photography. Cyanotypes, and making ink from natural sources. Draw and paint using natural links and watercolors. Work with foundational principles of art and design while developing your artistic sensibility.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Junior, Senior

ART 2201 - Art History

An open-ended survey of the history of art and arts practices. Class puts traditional/well-known movements (Greek architecture, the Renaissance) in context with global cultural works, and examines both traditional and contemporary arts.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand

ART 2350 - Scenic Art & Scenic Illustration

Large-scale drawing and painting for theatre, opera, museums, and special projects, such as community murals. Emphasis is on matching a designer's vision or "scaling up" a designer's rendering to very large scale. Includes a community/professional painting project.
Credits: 3.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring, in even years

ART 2950 - Creative Campus: Local Arts Immersion

Experiential arts learning. Students attend local/regional gallery exhibits, museums, design festivals, music events, and performances on campus and off; participating in and reflecting on cultural life. Art, music, theatre, and arts engagement. Includes events, discussions, and creative projects.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring

ART 3130 - Creative Drawing II

Concentrated instruction on realistic drawing combined with methods for seeing the world anew. Combines basic drawing skills with practices of 'flow', 'mindfulness', and 'radical juxtaposition'. Sketch with your cellphone camera, make pencil, charcoal drawings, and collages only you can imagine
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): ART 1100 or ART 1110 or ART 2100 or ART 2195 or ART 3180 or ART 4450

ART 3140 - Creative Ceramics

Addresses ceramic theory, history, and science, and aims to develop the content and quality of students' work in clay. Students will learn new ways of creating forms through use of the wheel, molds, and study of clay and glaze technologies.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Pre-Requisite(s): ART 1110 or ART 2140 or ART 2145 or ART 2160 or ART 2190 or ART 2195 or ART 3145 or ART 3190 or ART 3410 or ART 3420

ART 3145 - Ceramic Sculpture

Explores the material properties and expressive potential of clay. Learning a variety of sculptured techniques, students will demonstrate the ability to incorporate the elements and principles of art (line, space, form, harmony) to create works of art.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: On Demand
Pre-Requisite(s): ART 1110 or ART 2140 or ART 2145 or ART 2190 or ART 2195 or ART 3140 or ART 3410 or ART 3190

ART 3180 - Color and Creativity: Exploring the Power of Color through Paint, Composition, and Design

Use water-based paints to explore colors' expressive potential. Develop your personal color palette. Study color theory. Consider the visual and metaphorical power of color. Analyze colors in cultural contexts. Prior drawing experience highly recommended.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Pre-Requisite(s): ART 1100 or ART 1110 or ART 2100 or ART 2130 or ART 2190 or ART 2195 or ART 2350 or ART 3130 or ART 3190

ART 3190 - Art, Nature, and Contemplative Photography

Explore "nature spaces" and the "unbuilt world" through art using materials including cell phone photography and materials you find outdoors to create installations. Hikes provide inspiration and practice with creative fundamentals. Cultivate "flow" attentiveness, and learn visual analysis.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ART 3410 - Contemporary Sculpture Studio

Introduction to contemporary sculpture using a range of materials and practices: wood, fiber, paper, found objects. Emphasizes sculptures' ability for storytelling and student's personal creative language. Class is in Rozsa student gallery; includes student exhibit at end of semester.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring, in even years

ART 3420 - World Sculpture Traditions

Introduction to traditional ways of making sculpture around the world. Students develop studio skills while studying creative traditions from varied cultures. Hands-on studio work, lectures, discussions. Class takes place in Rozsa gallery; includes student exhibit at end of semester.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: On Demand
Pre-Requisite(s): ART 1100 or ART 1110 or ART 2110 or ART 2130 or ART 2140 or ART 2145 or ART 2190 or ART 2195 or ART 2350 or ART 3130 or ART 3190

ART 3850 - Special Topics: Art

Examines important themes, processes, and issues in art, including local and global traditions. Spans a variety of creative practices. Creative projects, lectures, readings, and discussions. May be repeated if topic differs.
Credits: variable to 6.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required

ART 3860 - Advanced Special Topics: Art

Advanced study of ideas, themes, and processes in studio art for students with significant arts background. Studio work, discussions, special projects. May be repeated if topic differs.
Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): ART 2190 or ART 2130 or ART 2100 or ART 3140 or ART 3145 or ART 3410 or ART 3420 or ART 3180 or ART 2130 or ART 2195 or ART 3190 or ART 3130

ART 3900 - Study Away: Regional Arts Immersion

A U.S.-based travel course focused on experiential arts learning. Students study theatre, arts, music, design, architecture, and arts engagement, considering local, regional, and national contexts. Experiences include gallery exhibits, museums, design festivals, live performances; participating in and reflecting on cultural life.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ART 3950 - International Arts Immersion

An International travel course focused on experiential arts learning. Students study theatre, art, music, design, architecture, and arts engagement, considering local traditions and international context. Experiences include gallery exhibits, museums, design festivals, live performances; participating in and reflecting on cultural life.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ART 4410 - Advanced Sculpture Studio

Upper-level sculpture course focused on student's personal arts language and an open-ended idea of what "sculpture" can be. Class takes place in the Rozsa student gallery, and includes exhibit at end of semester.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-4)
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): ART 3140 or ART 3145 or ART 3410 or ART 3420

ART 4440 - Advanced Ceramics

Students build on skills from prior hand-building, throwing, and ceramic sculpture coursework, developing greater technical skills and aesthetic sensibilities. Class also studies historic and contemporary ceramics, art criticism, and student's personal creative language.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): ART 2140 or ART 2145 or ART 2190 or ART 3140 or ART 3145 or ART 3410 or ART 3420 or ART 3190

ART 4450 - Advanced Creative Drawing and Painting Studio

Explores contemporary and traditional drawing and painting practices. Develops students' own arts language. Experiments with varied materials. Prepare to unlock your creativity and expand your definitions of "drawing" and "painting". Course emphases change each semester.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (ART 1100 or ART 2100 or ART 2130 or ART 2195 or ART 2350 or ART 3130) and (ART 3180 or FA 3180)

ART 4700 - Studio Research Assistant

A special-project course. Students work as a studio/research assistant to art faculty on professional projects, such as gallery, field work, studio, or public art.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): ART 2100 or ART 3140 or ART 3180 or ART 3410 or ART 3420 or ART 3145 or ART 2130 or ART 3130 or ART 2195

ART 4800 - Independent Study: Art

Self-directed independent research project. Requires a written proposal setting out goals, plans for final project, and the resources required to complete the project.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

Biomedical Engineering

BE 2100 - Undergraduate Biomedical Engineering Seminar

An overview of biomedical engineering designed especially for freshmen and sophomores that includes presentations by faculty, members of the community and other guest lecturers. Topics ranging from clinical engineering through basic biomedical engineering research are covered.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

BE 2110 - Statistical Methods for Biomedical Engineering

Topics include descriptive statistics, sampling methods, probability, statistical inference, causality, elementary design of experiments, statistical process improvement methods including Six-Sigma techniques, clinical trial methodology, and variance analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 1135 or MA 1160 or MA 1161 or MA 1121

BE 2400 - Cellular and Molecular Biology

General principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): CH 1150 and MA 1160 or MA 1161 or MA 1121

BE 2700 - Biomedical Signals & Systems

Introduces the origin, processing and interpretation of biological signals. Mathematical modeling techniques used in the analysis of linear systems. Topics include: Fourier, Laplace and z-transforms, signal comparison techniques, power spectrum analysis, 2-dimensional signals, transfer functions, convolution, and simulations. Prerequisite of CH1150, MA2160, and PH2100 with a C or better is required.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1150 and PH 2100 and MA 2160 and ENG 1102

BE 2800 - Biomaterials I: Fundamental Materials Science and Engineering

Introduction to the fundamental materials science principles and different classes of biomaterials (metals, ceramics, polymers and their composites), and some practical professional issues concerning the field of biomaterials.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BE 2400

BE 3300 - Biomechanics I: Statics and Dynamics

Course provides overview of two and three-dimensional force and structure systems and their applicability to human body. Course topics will include principle of equilibrium, concept of free-body diagram, moment of inertia, centroids. Kinematics and equations of motion, principle of energy, work and momentum. Course materials tailored for biological applications, particularly for applications at human organ level.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior
Pre-Requisite(s): BE 2400 and (MA 2321 or MA 2320 or MA 2330) and (MA 3521 or MA 3520 or MA 3530) and BL 2010(C)

BE 3350 - Biomechanics II: Soft Tissue and Bio-Fluid Mechanics

This course teaches basic principles of mechanics that are closely related to human soft tissue and bio-flow, particularly, at the human organ level. Emphases are given to both engineering fundamentals and biomedical applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior
Pre-Requisite(s): BE 3300

BE 3400 - Experimental Techniques in Biomedical Engineering

Introduction to the experimental techniques used in biomedical engineering, technical report writing, and record keeping.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall
Pre-Requisite(s): BE 2800

BE 3550 - Fluid Mechanics

This course introduces fundamental fluid mechanics principles in a unified fashion so that students can describe biological fluid problems in precise mathematical language. Topics include nature of fluids, hydrostatics, differential and integral equations about conservation of mass and momentum, dimensional analysis and various types of flow.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MA 3160 and (MA 3520 or MA 3521) and BE 3300

BE 3700 - Biomedical Instrumentation

Introductory theory of measurement and analysis from biological systems. Covers the principles and use of transducers, data recording and analysis systems and signal processing techniques. Example measurements include life science research and clinical measurements such as the vital signs.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior
Co-Requisite(s): BE 3701
Pre-Requisite(s): EE 3010 and PH 2200(C) and BL 2020(C) and BE 2700

BE 3701 - Biomedical Instrumentation Lab

Laboratory exercises to demonstrate basic instrumentation principles and biomedical measurements. Students will learn how to make non-invasive measurements on themselves and how to evaluate measurement instrumentation. Course will coincide with BE3700 lectures.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior
Co-Requisite(s): BE 3700

BE 3800 - Biomaterials II: Properties and Biological Interactions

Biomaterials properties including structure-function relationships (materials composition and properties), protein/cell materials interactions, characterization methods, and handling and processing considerations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): BE 2700(C) and BE 2800

BE 3981 - LabVIEW Basics

Learn how to program LabVIEW, a popular data acquisition and automation language used by engineers. Programming is done graphically which makes it easy to learn and use. Some of the topics covered: LabVIEW environment, how to construct graphical user interfaces, loops, debugging, writing data to disk and an intro to data acquisition.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring

BE 4000 - Independent Study

Students undertake an independent study under the guidance of a Biomedical Engineering faculty member. The course of study may either be research or academic and is decided upon between the student and faculty member.
Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required

BE 4115 - Finite Element Modeling

This course teaches both fundamentals of finite element theory and hands-on experience for bio engineers.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): (MA 2320 or MA 2321) and (MA 3520 or MA 3521) and (BE 3350 or MEEM 2150)

BE 4200 - Cellular and Molecular Biology II

Covers, at an advanced level, the general principles and engineering applications of science and biology, including cell biology, physiology, molecular biology, genetics, and biotechnology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BE 2400

BE 4230 - Stem Cell and Tissue Engineering

This course will introduce basic concepts of tissue engineering; scaffold materials and biotechnologies for tissue engineering; basic concept of stem cells; review of stem cell sources and related policies; current progress in stem cell research, and application of stem cells in tissue engineering and regenerative medicine.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BE 2400 and BE 3350 and BE 3800

BE 4250 - Biomedical Optics

Light plays a significant role in modern clinical diagnostics and in the clinical treatment of disease. Examples include non-invasive surgery, optical biopsy, and cancer therapy. This course will focus on the study of how light propagates through biological tissue.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): (MA 2320 or MA 2321 or MA 2330) and (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

BE 4300 - Polymeric Biomaterials

This course focuses on the use of polymeric materials in biomedical engineering. Topics will include synthesis and characterization of polymers, structure-properties relationships, degradation behavior, and biomedical applications for polymeric biomaterials.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): BE 3800

BE 4330 - Biomimetic Materials

This course introduces students to biologically inspired approaches to design functional biomaterials. Topics include the discovery and incorporation of biological designs into novel materials and their application in the biomedical field.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): BE 3350 and BE 3800

BE 4335 - Smart Polymers

This course introduces students to smart polymers that change their physical properties in response to various environmental stimuli. Topics include the molecular origin of the stimuli responsiveness of these materials and their applications in the biomedical field.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): BE 3350 and BE 3800

BE 4340 - Biocompatibility

Students will learn the general principles and biomedical engineering applications of biocompatibility. Students will be able to critically read the international standards in the are of biocompatibility.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BE 2400 or BE 4200 or BE 5200

BE 4350 - Cell Biomechanics and Mechanical Transduction

This course is designed to introduce the mechanical analysis and characterization of mammalian cells. Mechanotransduction, whereby cells detect loading and respond to the morphology and mechanical properties of the surrounding extracellular matrix, will be emphasized.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): BE 2400 and BE 3350 and BE 3800

BE 4410 - Medical Imaging

This course covers the physical nature of the interactions between the waves and matter, especially the biological tissues, principle imaging modalities used in modern medicine and the common techniques used for the processing of the resulting images.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BE 3700 and BE 3701

BE 4510 - Cardiovascular Engineering

This course introduces and reviews fluid dynamics in the context of cardiovascular flows. Applications include analysis of unsteady blood flow, flow through heart valves, blood flow and cardiac chamber fluid-structure interaction, and flow related blood damage.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BL 2020 and BE 3350 and BE 3550

BE 4530 - 3D Bioprinting

This course will cover the principles of 3D bioprinting to develop therapeutic products. Topics include tissue engineering, introduction of 3D bioprinting techniques, biomaterials and chemistries for the development of bioinks, cell-bioink interactions, and case studies of the application of 3D bioprinting in healthcare.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BE 2400 and BE 3800

BE 4650 - Neural Basis of Rehabilitation Engineering

Basic neuroscience topics underlying sensorimotor control will be introduced. Different types of neuromuscular disorders and current techniques used for diagnosis, assessment, and rehabilitation interventions will be studied.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BE 3350 and BL 2010 and BL 2011 and BL 2020 and BL 2021

BE 4655 - Neural Prosthetic Systems

This course will cover systems that use electrical stimulation to restore normal function following injury or disease. The underlying biophysical basis and technology for treatment, clinical applications and challenges will be studied. Topics include spinal cord stimulation for pain relief, cochlear implants, brain and neuromuscular stimulation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BE 3700 and BL 2010 and BL 2011 and BL 2020 and BL 2021

BE 4670 - Micro & Nano Technologies

This course will introduce students to micro- and nano- technologies and the processes involved in manufacturing. Particular emphasis will be on their use in biomedical applications. Goal is to provide information beneficial in research and development, and the industry.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): PH 2100 or EE 2110 or EE 3010

BE 4700 - Biosensors: Fabrication & Applications

This course introduces the student to the fundamentals of biosensor development and applications. It provides an understanding of biological components, immobilization methods, transducers, and fabrication techniques.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BE 3700 and BE 3701

BE 4701 - Advanced Statistical Methods for Engineering

Introduction to the design, conduct, and analysis of statistical studies, with an emphasis on engineering applications. This course covers fundamental statistical concepts, including descriptive and graphical methods, probability models, parameter estimation and hypothesis testing, and experiment design, and data interpretation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MA 1160 or MA 1161

BE 4755 - Medical Devices

An introduction to medical devices used for diagnosis, monitoring, and treatment in clinical medicine. Topics covered include product planning, reliability, clinical trial design, regulatory as well as technical aspects of common medical devices.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BE 3700

BE 4770 - Biomedical Microcontrollers

The focus of this course is to provide biomedical engineering students the necessary skills to develop microcontroller-based devices. Provides basic knowledge on computer programming languages, microcontrollers, digital circuits, and microcontroller development kits. Students will design and fabricate a microcontroller-based device using a microcontroller development kit for a specific biomedical application.
Credits: 3.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): BE 3700 and BE 3701

BE 4850 - Tissue Mechanics

This course integrates continuum mechanics, experiments, and computational methods to understand soft tissue mechanics. The first half of the course is dedicated to building continuum mechanics foundation, which will be used to formulate constitutive equations for arteries and the heart in the second half.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BE 3350

BE 4870 - Computer Vision for Microscopic Images

This course teaches how to quantify data out of images, typically from optical microscopes. It covers thresholding, image derivatives, edge-detection, watershed, multi-scale and steerable filters, 3D image processing, feature extraction, PCA, classification, convolutional neural networks, particle tracking, and diffusion analysis.
Credits: 3.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall, in even years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BE 2700

BE 4900 - Biomedical Design Fundamentals

Design considerations and professional practice issues are addressed. Ethics, regulatory affairs, and intellectual property are addressed within the context of the biomedical engineering profession. Modern tools of biomedical design are presented and applied to current problems.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

BE 4901 - Biomedical Design Project I

Team approach is used to resolve a defined problem in biomedical engineering. Projects are selected and undertaken with faculty guidance and sponsor input. Must be senior project ready, as defined by major, substitutes for prerequisites.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biomedical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): BE 3350 and BE 3700 and BE 3701 and BE 3800 and BE 4900

BE 4910 - Biomedical Design Project II

Continuation of Biomedical Design Project I (BE4901) under faculty guidance. Emphasizes design and testing of prototypes. Requires work project notebooks, oral and written reports, and presentations.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): BE 4900 and BE 4901

BE 4930 - Biomedical Engineering Topics

Biomedical engineering courses will be offered on new or emerging technical subjects depending on student demand and faculty interest and expertise.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Level(s): Graduate

Biological Sciences

BL 1100 - General Biology I: Introduction to Organismal Biology, Ecology, and Evolution

A discussion of the principles of ecology and organismal biology, using the theme of physiological ecology and adaptations. This course will emphasize biodiversity, scientific method, experimental design, and written and oral presentation of results.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer

BL 1110 - General Biology I Laboratory: Introduction to Organismal Biology, Ecology, and Evolution

Covers principles of ecology and organismal biology, using the theme of physiological ecology and adaptations. This course will emphasize biodiversity, scientific method, experimental design, and written and oral presentation of results.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Summer
Co-Requisite(s): BL 1100

BL 1200 - General Biology II: Introduction to Cellular and Molecular Biology

Discussion of the major principles by which life is organized. Topics include scientific methods, biological chemistry, cell structure and organization, multicellular organization, diversity of organisms, energetics and photosynthesis, cellular reproduction genetics, gene structure and expression, and recombinant DNA.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer

BL 1210 - General Biology II Laboratory: Introduction to Cellular and Molecular Biology

Topics include scientific methods, biological chemistry, cell structure and organization, multicellular organization, diversity of organisms, energetics and photosynthesis, cellular reproduction genetics, gene structure and expression, and recombinant DNA.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring, Summer
Co-Requisite(s): BL 1200

BL 1400 - Principles of Biology

Basic principles through which biological systems operate. Topics include cell biology, structure and function, energy production, genetics, physiology, diversity, evolution, and ecology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Major(s): Computational Biology, Medical Laboratory Science, Human Biology, Biochem & Molec Biology-Bio Sc, Biological Sciences, Ecology & Evolutionary Biology

BL 1410 - Principles of Biology Laboratory

Topics include cell biology, structure and function, energy production, genetics, physiology, diversity, evolution, and ecology.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Major(s): Computational Biology, Medical Laboratory Science, Human Biology, Biochem & Molec Biology-Bio Sc, Biological Sciences, Ecology & Evolutionary Biology
Co-Requisite(s): BL 1400

BL 1580 - First Year Experience in Biological Sciences

Introduction to fields and career opportunities in the biological sciences.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Biochem & Molec Biology-Bio Sc, Ecology & Evolutionary Biology, Human Biology, Biological Sciences, Computational Biology; Must be enrolled in one of the following Class(es): Freshman, Sophomore

BL 1590 - First Year Experience in Health Professions

Introduction to various careers in the health professions. Discusses required course work, entrance exams, and other requirements for entry to the various fields. Guest lecturers include representatives of many health areas.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

BL 1600 - First Year Experience in Medical Laboratory Science

Introduction to subdisciplines, the clinical practicum, career opportunities, and current issues in medical laboratory science.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science

BL 1710 - Medical Terminology

Auto tutorial course covers the fundamentals of medical terminology, including recognition and use of common prefixes, roots, and suffixes, as well as single-syllable words. Exercises also include spelling and pronunciation.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall

BL 2000 - Biology of Movement and Meditation

Students will explore the science behind the practice of yoga, including poses, meditation, anatomy & physiology. Will read peer-reviewed literature excerpts regarding yoga research. Physical practice, no prior experience necessary. Yoga supplies required.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand

BL 2001 - Valuing the Great Lakes

The Great Lakes are used as the subject to examine environmental issues. A combination of reading, lecture, and discussion will be used to study the unique ecology, biology, and history of the Great Lakes.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer

BL 2003 - Field Observation and Data Collection

Best practices for observing, collecting, and recording ecological and evolutionary biology data in the lab and field.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Ecology & Evolutionary Biology, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1580

BL 2010 - Anatomy & Physiology I

Comprehensive introductory course in vertebrate anatomy and physiology with emphasis on the human body. Interrelates structure with function in regard to maintaining homeostasis and normal functioning of the body. Covers the integument, skeletal system, muscles, the nervous system, and special senses.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer

BL 2011 - Anatomy & Physiology I Lab

The laboratory to accompany BL2010. Examines embryology, muscle and skeletal anatomy, and neuroanatomy. Explores the physiology of the nervous system, including vision and reflexes and muscle physiology. A student-designed lab project is used to teach experimental design.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer
Pre-Requisite(s): BL 2010(C)

BL 2015 - Introduction to Neuroscience

Fundamental principles will be introduced including nervous system anatomy, current methods used in neuroscience and how the nervous system generates behavior and cognition. Neural function is studied at the levels of molecules, cells, circuits, and organisms.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1020 or BL 1040 or BL 2010 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

BL 2020 - Anatomy & Physiology II

Continuation of BL2010. Covers the cardiovascular, respiratory, digestive, renal, and reproductive systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): BL 2010

BL 2021 - Anatomy & Physiology II Lab

The laboratory to accompany BL2020. Examines the structure and function of the digestive, respiratory, cardiovascular, and renal systems. A student-designed lab project is used to teach experimental design.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring, Summer
Pre-Requisite(s): BL 2011 and BL 2020(C)

BL 2160 - Botany

Covers structure, function, reproduction, and classification of plants and algae, relating these current ecological, agricultural, or other human issues.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring

BL 2170 - Zoology

Biology of animals from first organized multi-cell through Hominids; the origin and evolution of the metazoa phyla, their physiology, development, ecology, behavior, natural history, and systematics.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring

BL 2200 - Genetics

A study of classical and molecular genetics. Topics include one- and two-locus genetics, recombination, gene structure, regulation and function, quantitative and population genetics, and genetic engineering. Covers both prokaryotes and eukaryotes.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 1020 or BL 1040 or BE 2400 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

BL 2210 - Genetics Laboratory

Emphasis on genetic and molecular biology laboratory techniques, including Mendelian analysis, and molecular cloning, Includes Course-based Undergraduate Research Experiences (CUREs) that cover the basis of scientific research in the life sciences.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 2200(C)

BL 2410 - Basic Medical Laboratory Techniques

Introduces a variety of fundamental diagnostic procedures performed in a typical clinical laboratory.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1020 or BL 1040 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

BL 2500 - Biology Research Experience

Students work in a research lab under the direction of a faculty member, contributing to ongoing research and/or experiments. Specifics to be agreed upon between the faculty mentor and student.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required
Pre-Requisite(s): (BL 1100(C) and BL 1110(C)) or (BL 1200(C) and BL 1210(C)) or (BL 1400(C) and BL 1410(C))

BL 2700 - Principles of Computational Biology

This course discusses how biology, math, and computer science combine to form the basis of computational biology. Students will be exposed to the applications of bioinformatics in analysis of DNA and protein sequences and be introduced to common methods for processing this data.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): BL 1020 or BL 1040 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

BL 2940 - Human Nutrition

Covers basic and applied chemistry and biology of human nutrition. Includes practical information on planning and adopting a healthy diet as well as maintaining acceptable weight. Emphasizes social, global, and environmental issues pertinent to use of the world food supply.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer

BL 3001 - Emergency Medical Technician 1

EMT-1 is the first in a two-course sequence that prepares students to evaluate and treat medical and traumatic emergencies in pre-hospital and emergency situations. Students learn about human health, pathophysiology, emergency medicine and treatments, and critical thinking to help them assess and treat patients while preparing for the EMT exam.
Credits: 5.0
Lec-Rec-Lab: (4-0-1)
Semesters Offered: Fall
Restrictions: Permission of instructor required

BL 3002 - Emergency Medical Technician 2

EMT-2 is the second in a two-course sequence that prepares students to evaluate and treat medical and traumatic emergencies in pre-hospital and emergency situations. Students build on and apply knowledge learned in EMT-1 in preparation for the national EMT exam.
Credits: 5.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): BL 3001

BL 3003 - Data Interpretation and Critical Analysis

This class will develop skills for interpreting and critically evaluating data and analyses of data to evaluate hypotheses in ecological and evolutionary biology. Students will practice peer review and analyzing published research articles.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Ecology & Evolutionary Biology, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2003 and MA 3715(C)

BL 3006 - Graduate Health Program Application Preparation

Course will assist students with the application process for graduate health professional programs (medical, dental, PA, etc.). Topics covered will include writing about experiences, developing a personal statement, asking for letters of recommendation, and conducting interviews.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): BL 1590 or KIP 1000

BL 3012 - Essential Cell Biology

This course will provide an understanding of cell structure and function with emphasis on eukaryotic cells. Topics include macromolecules, membranes, organelles, cytoskeleton, division, differentiation, cell-cell interactions, intracellular trafficking, protein sorting, cell signaling, and motility.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1020 or BL 1040 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

BL 3020 - Biochemistry I

Structure, biochemical properties, and function of important biomolecules such as proteins and nucleic acids. Introduces enzyme biochemistry (structure, function, catalysis, kinetics, and inhibition).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): (BL 1020 or BL 1040 or BE 2400) or (BL 1200 and BL 1210) or (BL 1400 and BL 1410) and (CH 2410 or CH 2420)

BL 3025 - Biochemistry for Health Professions

A comprehensive investigation of biomolecules including proteins, nucleic acids, and enzymes to understand their roles in structural, metabolic, developmental pathways. This course emphasizes biochemistry as it relates to human development, physiology, and disease.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Major(s): Biochem & Molec Biology-Bio Sc
Pre-Requisite(s): (BL 1200 or BL 1400 or BE 2400) and (CH 2410 or CH 2430)

BL 3044 - Advanced Human Physiology

A course for students interested in health careers or human biology. This course will cover advanced topics in the human circulatory, digestive, endocrine, integumentary, lymphatic, muscular, nervous, renal, reproductive, respiratory, and skeletal systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years, Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2020

BL 3090 - Spirituality in Healthcare

The course will provide students with greater understanding of the interaction between spirituality and healthcare. Students will be encouraged to explore and define their own spirituality, identify and consider the spirituality of others, and explore the interaction between spirituality, health, illness, and adversity.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

BL 3210 - General Microbiology

Introduction to the general principles and techniques involved in the study of microorganisms, including bacteria, fungi, and viruses. Topics include cell structure and function, growth, metabolism, biodiversity, and interaction. Not open to students with credit in BL3310.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1020 or BL 1040 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

BL 3230 - Medical Bacteriology

Study of pathology, identification, isolation and antimicrobic susceptibility testing of clinically important bacteria.
Credits: 5.0
Lec-Rec-Lab: (3-0-5)
Semesters Offered: Spring
Pre-Requisite(s): BL 3210

BL 3300 - Introduction to Genomics

Introduction to Genomics. Genome organization, mapping and characterization from humans and related organisms. Topics include hierarchical arrangement of genes, genome mapping, molecular markers of physical genome maps, genome sequencing, comparative genomics, analysis of important human genes and their products, and ethical and legal aspects of genomics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2200 or FW 3320

BL 3310 - Environmental Microbiology

General principles of microbiology, focusing on both the use and control of microorganisms. Topics include microbial structure, function, growth, metabolism, and diversity, as well as microbial involvement in water and waste treatment, waterborne diseases, and pollution control. Not open to students with credit in BL3210.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1200 or BL 1400 or BL 1020 or BL 1040 or BL 3080

BL 3490 - Principles of Ecology and Evolution

Study of the pattern and processes of organic evolution and their relation to ecological relationships at the organism, population, community, and ecosystem levels.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Pre-Requisite(s): BL 1010 or BL 1040 or (BL 1100 and BL 1110) or (BL 1400 and BL 1410)

BL 3600 - Clinical Practicum and Career Preparation Seminar

Presents an overview of clinical practicum experiences, including the NAACLS-accredited university-route and hospital-based programs. Outlines pathways for national certification for medical laboratory scientists. Addresses other career options and professionalism for the medical laboratory scientist.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): 4+1, 3+1; May not be enrolled in one of the following Class(es): Freshman

BL 3611 - Principles and Practice of Phlebotomy

This course covers the collection, processing, and transportation of specimens for laboratory analysis. Emphasis will be placed on hands-on phlebotomy training using proper techniques and precautions.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2410

BL 3640 - General Immunology

Investigates the immune defense system that has evolved to protect vertebrates from invading pathogens and cancer. Covers general principals of innate and acquired immunity, immunodeficiency and autoimmune diseases, as well as transplantation immunology, and the role of apoptosis in lymphocyte maturation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Biological Sciences, Computational Biology, Medical Laboratory Science, Human Biology, Biochem & Molec Biology-Bio Sc, Biochem & Molec Biology-Chem, Biomedical Engineering, Pharmaceutical Chemistry; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1020 or BL 1040 or BL 2020 or BE 2400 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

BL 3782 - Writing Practicum in Biology

Students will develop and improve their skill level in searching for scientific literature, incorporating that into scientific writing, evaluating and incorporating the work of others, and develop critique skills for review of scientific source material and basic statistical methods.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Biochem & Molec Biology-Bio Sc, Ecology & Evolutionary Biology, Human Biology, Biological Sciences, Computational Biology; May not be enrolled in one of the following Class(es): Freshman

BL 3800 - Medical Mycology, Virology, and Parasitology

An overview of medically relevant fungal, viral, and parasitic infections, including disease pathology. Emphasis on identification, diagnoses, and disease monitoring, as well as identifying and reducing pre-analytical, analytical, and post-analytical errors. Quality control, quality assurance, and safety will be addressed.
Credits: 2.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2410 and BL 3210 and BL 2020(C)

BL 3820 - Biochemical Laboratory Techniques I

Laboratory techniques basic to biochemistry and molecular biology with emphasis on protein isolation, characterization and kinetics.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 3020(C) or CH 4710(C) or BL 3025(C)

BL 3900 - Urinalysis and Body Fluids

Advanced theory and practical applications used in analysis of urine and body fluids. Topics include pathology of relevant body systems as well as physical, chemical, and microscopic examination of body fluids. Quality control and safety will be addressed in addition to pre-analytical, analytical, and post-analytical errors in testing.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2020 and BL 2410(C)

BL 3970 - Current Health Issues

Introduction to health issues, such as: infectious diseases, obesity, mental health, healthcare disparities, health insurance, drug addiction, and vaccines. Students will analyze health issues from a diverse cultural, ethical, social, and global perspective.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

BL 3990 - Biological Sciences Teaching Experience

Development of teaching skills through assisting in the instruction of a section of biological sciences laboratory. Students gain experience in leadership, group work, organization skills, laboratory preparation, and laboratory instruction.
Credits: variable to 4.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

BL 3999 - Biological Sciences Field Experience

In this course students will gain intensive field experience in Biological Sciences emphasizing immersion and observation in novel field settings. Students in this course will visit different ecosystems during day and weekend trips that explore aspects of ecology, evolution, community dynamics and human impacts on ecosystems.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required

BL 4000 - Research in Biology

Students conduct empirical, theoretical, or computational research under the direction of a faculty member. The work culminates in a written report, product, or presentation resulting from work performed. Specifics to be agreed upon between faculty mentor and student.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

BL 4020 - Biochemistry II

Dynamic aspects of living systems. Broad exposure to cellular metabolic pathways, intermediary metabolism and its regulation and bioenergetics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): BL 3020

BL 4030 - Molecular Biology

Molecular biology of gene structure, expression and regulation. Also topics covering various molecular techniques and applications of these techniques and biotechnology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3020 or CH 4710 or BL 3025

BL 4034 - Advanced Evolutionary Ecology

This is an advanced course that looks at the study of evolutionary ecology at the phenotypic level: how populations interact with their environment to determine evolutionary trajectory. Focus on all mechanisms of evolution, dissecting mathematical equations & techniques commonly used. Involves reading peer reviewed literature, critical thinking, presenting and scientific inquiry.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3490

BL 4035 - Bioimaging

Current concepts in light and electron microscopy and scanning probe techniques. Theory and practice of fluorescence (including confocal and multi-photon), atomic force, scanning and transmission electron, and video microscopy as applied to biological specimens with emphasis on sample preparation. Half semester course.
Credits: 2.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, in even years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

BL 4038 - Epigenetics

An introduction to the fundamentals of epigenetic control that is not encoded by genomic DNA sequences of an organism. Topics include major regulatory mechanisms including DNA methylation, histone modification, and non-coding RNA (ncRNA) mediated gene regulation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3300 or BL 4030

BL 4044 - Human Pathophysiology

Course will cover abnormal function (physiology) and investigate the signs and symptoms of major diseases in humans. Extension of Anatomy & Physiology by working through the systems of the human body. Course will include a clinical focus and case-study approach.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2010 and BL 2020

BL 4052 - Fluorescence and Video Microscopy of Biological Specimens

Hands-on training in fluorescence microscopy and video microscopy. Students prepare biological specimens of their choice for observation. Half semester course.
Credits: 2.0
Lec-Rec-Lab: (0-2-6)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 4035

BL 4070 - Environmental Toxicology

Introduction to the range of anthropogenic pollutants released into the environment. Concepts of bioaccumulation, biomagnification and environmental persistence, modes of toxicity and detoxification, transport and fate in aquatic and terrestrial ecosystems. Toxic equivalent factors and quotients, regulatory guidelines and practices.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1020 or (BL 1200 and BL 1210) or BL 1040 or (BL 1400 and BL 1410) and CH 1150 and CH 1160

BL 4090 - Tropical Island Biology

Survey of tropical island biology presented on campus and in the Bahamas over spring break. Topics include geological and societal history, and the biology and ecology of terrestrial, intertidal, and coral reef communities. Special course fees. Requires instructor approval to register.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Restrictions: Permission of instructor required

BL 4100 - Special Topics in Biological Sciences

A study of recent developments in the biological sciences.
Credits: variable to 10.0; Repeatable to a Max of 10
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

BL 4120 - Environmental Remediation

Toxicology of major environmental pollutants, their dose-response relationships and fundamentals of environmental remediation. Topics include physical, chemical, and biological remediation methods and effect of environmental toxins on biological systems. Laboratory will involve the application of chemical and biological remediation techniques.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1020 or BL 1040 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

BL 4140 - Plant Physiology

Physiology and biochemistry of plants. Emphasizes photosynthesis, plant hormones, water and nutrient relations, and light-regulated development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): BL 2160 and CH 2420

BL 4141 - Algae

The Lake Superior watershed has a rich, diverse, algal flora inhabiting numerous acid bogs, peatlands, ponds, lakes, fens, streams, rivers. This course emphasizes field collections and microscopic identification and includes discussions of algal culture techniques, invasives, blooms, limnology, and algal biotech.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (BL 1010 or BL 1100 and BL 1110) and (BL 1020 or BL 1200 and BL 1210) or BL 1040 or (BL 1400 and BL 1410) or BL 3080

BL 4145 - Plant-Microbe Interactions

Interactions between plants and microorganisms in the environment. Topics include microbial virulence, signaling, gene expression, beneficial interactions and disease resistance in plants. Laboratory will focus on plant biochemical and microbiological methods as they relate to environmental problems.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2200

BL 4153 - Applied Genome Editing

This course offers training in genome editing design and implementation. Practical demonstrations of genome editing techniques will be included. History and ethics of genome editing will be discussed.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2200 or FW 3230

BL 4200 - Microbial Physiology

Structure and function of microorganisms, with emphasis on mechanisms for responding to changing environmental and nutritional conditions.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): BL 3210 or BL 3310

BL 4300 - Applied Bacterial Genomics

This course is an overview of techniques involved in genomics including hands-on experience in next-generation sequencing (NGS) platforms, and NGS sequence analysis including de novo assembly, gene annotation, and analysis including comparative genomics, pathway mapping, and core and pan genome analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): BL 2200

BL 4310 - Applied Eukaryotic Genomics

This course is designed as a hands-on experience in eukaryotic genomic experiments involving next generation sequencing (NGS) techniques, including eukaryotic gene annotation, comparative genomics, and gene regulation analyses.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2200 and BL 2210

BL 4370 - Advanced Cell Biology

Celebration of the commonalities of life as exhibited in the basic building block of organisms - the cell. Course topics include details of basic genetic mechanisms, cell structure and function, and an examination of cells in their social context.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 2200 and CH 2420

BL 4380 - Cardiopulmonary Physiology

Using a problem-based learning approach, course examines the physiology of the human body. In-class case-study analyses provide in-depth learning about the cardiovascular and pulmonary systems and their relationship with other organ systems. Promotes development of problem-solving skills.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): BL 2020

BL 4395 - Stable Isotopes in Ecology

Fundamentals of stable isotope ecology and biogeochemistry. Topics include stable isotope systematics and principles, application to ecological questions across levels of organization, interpretation and manipulation of stable isotopic data, and critical evaluation of the literature.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, in even years
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3490 and (BL 3020 or CH 1150 and CH 1151)

BL 4400 - Microbial Ecology

Interactions between microorganisms and between microorganisms and the environment with focus on the processes mediated by and controls on microbial life, and the methods used in the rapidly evolving field of microbial ecology. Emphasis on primary literature and discussion.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): BL 3210 or BL 3310 or BL 3490

BL 4410 - Developmental Biology

The course will cover developmental biology topics from gametogenesis over fertilization, embryonic development to postembryonic development, including aging. Developmental genetics and the evolution of development (evo-devo) are an important component of this course.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2200 and (BL 3012(C) or BL 4370(C))

BL 4421 - Lake Superior Exploration

A field intensive course with significant time spent on a research vessel (R/V Agassiz or other) where students will learn the use of a variety of state-of-the-art techniques to characterize biological communities and measure important physical and biological processes.
Credits: 3.0
Lec-Rec-Lab: (4-0-6)
Semesters Offered: Summer, in odd years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

BL 4440 - Fish Biology

Fishes and their habitat, native and exotic fishes of the Great Lakes region, and ocean fishery resources will be examined. Basic topics in Ichthyology and fish ecology, evolution, genetics, reproduction strategies and identification of early life stages, fish community structure, food webs and dynamics. Laboratory exercises on sampling, identification and classification of fishes and basic fish anatomy and discussion of scientific papers relevant to the subject material.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1020 or BL 1040 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

BL 4447 - Stream Ecology

Field course combining river and stream ecosystem and food web study with fishes in lake systems. Students will be exposed to research methods used in lakes for comprehensive abiotic and biotic understanding.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1010 or (BL 1100 and BL 1110) or BL 1040 or (BL 1400 and BL 1410) or BL 3400

BL 4450 - Limnology

The study of physical, chemical, and biological processes of freshwater eco systems with emphasis on lakes.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

BL 4452 - Advanced Ecology

This course is designed for students focusing their studies in ecology and evolutionary biology and seeking advanced understanding of pattern, science, and theory of ecological systems. Topics will range from individuals to communities and landscapes. Lectures and discussions will be guided by published literature.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Spring, in even years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 3003 and BL 3490

BL 4461 - Ecosystem Ecology

Study of processes in aquatic and terrestrial ecosystems, including energy flow, ecosystem production, and nutrient cycling. We will explore these processes through a historical overview of influential research programs and regional to global case studies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3490 and CH 1122 or (CH 1160 and CH 1161)

BL 4465 - Biological Oceanography

An overview of ocean environments and marine life. Topics include: trophic level interactions, nutrient cycling, ecology of plankton, invertebrates, fish, mammal and bird resources, and human influences on marine ecosystems. Will cover basic water chemistry and light in oceans.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1010 or (BL 1100 and BL 1110) or BL 1040 or (BL 1400 and BL 1410) or BL 3080

BL 4550 - Clinical Chemistry

A study of clinical biochemistry of the human body. Theory and practical applications used in routine analysis of body fluids. Includes the study of electrolyte balance, acid base balance, and the functions of major organs and systems.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Clinical Laboratory Science, Medical Laboratory Science, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2020 and BL 3640

BL 4600 - Professional Development Capstone for Biological Sciences

Assessment of experiential learning and preparation for post-graduate work, professional training, or graduate school.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): BL 3782

BL 4610 - Medical Laboratory Science Medical Practicum I

Practical and didactic training in clinical chemistry, immunopathology, and medical microbiology under the direction of National Accrediting Agency for the Clinical Laboratory Sciences (NAACLS)-approved/accredited hospital internship program personnel.
Credits: 12.0
Lec-Rec-Lab: (12-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science

BL 4611 - Medical Laboratory Science Medical Practicum II

Practical and didactic training in hematology, urinalysis, and immunohematology under the direction of National Accrediting Agency for the Clinical Laboratory Sciences(NAACLS)-approved/accredited hospital internship program personnel.
Credits: 12.0
Lec-Rec-Lab: (12-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science
Pre-Requisite(s): BL 4610

BL 4612 - Medical Laboratory Science University Clinical Practicum

Practical and didactic training in Medical Laboratory Science for students who have completed the NAACLS accredited MLS 4+1 degree. Course is under direction of the MLS Practicum Coordinator and conducted in affiliated hospitals. Upon completion, students are eligible to sit for the ASCP Board Registry Exam.
Credits: 12.0
Lec-Rec-Lab: (0-0-12)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required

BL 4640 - Clinical Immunology & Serology

Integrates basic and clinical immunological principles as well as outlines the diagnosis and evaluation of immune disorders and selected infectious diseases.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science, Biological Sciences; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2410 and BL 3640

BL 4660 - Current Topics in Medical Laboratory Science

Recent developments in Clinical Laboratory Science.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

BL 4720 - Hematology and Hemostasis

Theory and laboratory applications. Emphasis will be placed on hematopoiesis, normal and disease states affecting blood cells and coagulation processes. The lab will focus on cell morphology and practical testing applications.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2410(C) and BL 2020

BL 4725 - Immunohematology

Theory and practical applications in the blood bank. Emphasis will be placed on blood antigens and antibodies, compatibility testing techniques, blood component therapy and safety issues in the blood bank.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 2410(C)

BL 4752 - Cancer Biology

Emphasis on characteristic genetic, molecular, and cellular changes leading to cancer. Topics will include the role of tumor viruses, oncogenes, tumor suppressors, immortalization, apoptosis, and angiogenesis in cancer initiation and/or progression. Consideration of current therapies and future directions for treatment.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 3012 or BL 4370 or BE 2400

BL 4800 - Molecular Diagnostics

This course describes advanced concepts in molecular diagnostics as applied to the practice of laboratory medicine. Students are introduced to the theory and techniques used in paternity testing, identification of microorganisms, diagnosis of human disease. Basic hands-on laboratory experience in molecular diagnostic techniques.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Spring
Pre-Requisite(s): BL 2200 and BL 3025

BL 4840 - Molecular Biology Techniques

Laboratory techniques in molecular biology, including methods of recombinant DNA technology for identification, cloning, and characterization of genes.
Credits: 3.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2200 and BL 4030(C)

BL 4980 - Medical Laboratory Science Core Concept Integration and Application

SML Program Capstone Course. Review, and subsequently learn to integrate and apply, clinical core course material. Assignments include collaborative exercises involving development, peer review, and presentation of worksheets, case studies, and instrument evaluations, as well as other interactive learning activities.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Medical Laboratory Science; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3230(C) and BL 4550(C) and BL 4640 and BL 4720 and (BL 4730 or BL 4725)

BL 4995 - Research in Biochemistry

Students conduct empirical, theoretical, or computational research in biochemistry under the direction of a faculty member. The work culminates in a written report, product, or presentation resulting from the work performed. Specifics to be agreed upon between faculty mentor and student.
Credits: variable to 6.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

BL 4999 - Biological Sciences Internship

Practical and didactic internship experience directly related to student's course of study in biochemistry and molecular biology, bioinformatics, biological sciences, or ecology. Students conduct work at an approved internship site in addition to academic assignments that encourage them to connect their professional and academic experience.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

Business

BUS 1100 - Introduction to Business

Introduction to planning, organizing, decision-making, leadership and control in a business. Business disciplines of accounting, finance, information systems, management, marketing, and operations are introduced, along with discussions of business ethics and social responsibility.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

BUS 2100 - Business Statistics

Introduction to basic concepts and methods of probability and statistics, including the following topics: collection, description and presentation of data, probability, random variables, sampling, probability distributions, estimation and hypothesis testing, ANOVA, and selected non-parametric techniques.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): MA 1135 or MA 1160 or MA 1161 or MA 1121

BUS 2200 - Business Law

Provides an understanding of the legal basis of contracts and their enforcement in the areas of general contracts, contracts of commercial sales and of agency, and commercial paper.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring

BUS 2300 - Quantitative Problem Solving

Stresses development of quantitative decision and analysis skills to solve problems with cases, exercises, simulations, and mathematical modeling. Topics include regression analysis, decision analysis, stochastic environments, data sources and errors, utility theory risk preference, linear programming, and simulation analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): BUS 2100 or MA 2710 or MA 2720 or MA 3710 or MA 3720

BUS 3000 - Introduction to Business Analytics

Provides an introduction to the collection, processing, and communication of business data to inform business decisions. Some topics include: finding reliable and trustworthy data sources, collecting data, cleaning and transforming date, and basic descriptive statistics. The course introduces industry leading data processing and statistical tools.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): BUS 2300

BUS 3900 - Business Internship

A practical approach to business problem solving. Requires a report on work activity upon completion of the internship.
Credits: variable to 4.0; Repeatable to a Max of 5
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following College(s): College of Business

BUS 4900 - Research Projects

Under the general guidance of a faculty member, students read, conduct research, and prepare reports and papers as required. The SBE's Curriculum Committee must approve the subject of the proposed project.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

BUS 4950 - Business Project

Students work individually or in a team on a project under the guidance of a faculty advisor. The student(s) analyze a problem, develop a project plan, summarize findings, and make recommendations.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

BUS 4990 - Special Topics in Business

Business topics of interest to students and faculty.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

Civil & Environmental Engineering

CEE 1000 - Civil Engineering

An introduction to the civil engineering profession with emphasis on careers open to the civil engineering students. Topics include: scope, specialties, education, professional practice, life-long learning, contemporary issues, ethics and societal impacts related to civil engineering.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

CEE 1001 - Sustainability and Civil Engineering Practice

Course will focus on characterizing the motivation for and principles of sustainable engineering and provide an introduction to tools used in sustainable design. Course topics follow a logical and linear progression which includes the societal context, scientific motivation, and application of sustainable practices in civil engineering.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring

CEE 1003 - Introduction to Computer Aided Drafting

Fundamentals of creating engineering drawings with modern CAD software. Topics include basic geometric construction, drawing modification, dimensioning, and working with layers. Designed for students with no CAD experience.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

CEE 1501 - Experiences in Environmental Engineering

Provides a series of activities that explore the field of environmental engineering. Through completion of the course, students will gain fundamental experiences with the skills, knowledge, and attitudes needed to solve the complex environmental problems needing solutions from today's environmental engineers.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

CEE 3101 - Civil Engineering Materials

Covers properties and behavior of typical civil engineering materials, including wood, metals, aggregates, asphalt cement concrete, portland cement concrete, and composites. Laboratory exercises demonstrate selected engineering mechanics principles, including elastic, inelastic, and time-dependent material behavior. Additional topics include testing techniques, materials standards, report writing, and presentation of experimental data.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): ENG 2120 or MEEM 2150 or CMG 2120 or ME 2150

CEE 3200 - Thermodynamics/Fluid Mechanics

Provides engineering students with a unified understanding of the fundamental conservation laws and property accounting applied to thermodynamic and fluid dynamic systems. Topics will include but are not limited to: ideal gas behavior; heat, work, and energy; 1st and 2nd laws of thermodynamics; heat pumps; cycles; hydrostatics; Bernoulli; pipe flow and loss; and lift and drag.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CH 1150 and CH 1151 and PH 2100 and (ENG 1101 or ENG 1101T or CS 1111 or CS 1121 or CS 1131) and MA 2160

CEE 3202 - Structural Analysis

Introduction to structural concepts and techniques for analyzing trusses, determinate and indeterminate beams, and frame structures. Apply concepts from statics and mechanics of materials to determine internal forces and deflections of structural members and systems, including loads and load paths.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (ENG 2120 or MEEM 2150 or ME 2150) and (MA 2320(C) or MA 2321(C) or MA 2330(C))

CEE 3331 - Professional Practice

Professional expectations of civil and environmental engineers demonstrated through readings, discussion, and writing. Topics include the consequences of engineering, design issues, legal aspects, ethical considerations, government requirements, management, leadership, and contract issues.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

CEE 3332 - Fundamentals of Construction Engineering

Introduction to concepts required by professionals involved in the construction industry. Includes contracts, bidding, estimating, scheduling, cash flow, safety, labor issues, equipment ownership, and productivity.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

CEE 3401 - Transportation Engineering

Introduction to transportation in the United States, transportation mode characteristics and applications, highway geometrics and design standards, pavement design and management.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

CEE 3490 - Introduction to Sustainable Rail Transportation

Introduction to topics related to rail transportation and industry. Overview of North American passenger and freight railroads in the past and today, concentrating on aspects and developments highlighting railroads as the sustainable mode of transportation.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

CEE 3501 - Environmental Engineering Fundamentals

Basic principles and calculations for environmental engineering. Covers application of mass balance, energy balance, and physical/chemical/biological principles to water and wastewater treatment, surface water quality, air quality, solid waste management, and groundwater quality.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Environmental Engineering
Pre-Requisite(s): (MA 1160 or MA 1161) and MA 2160 and (CH 1112 or (CH 1150 and CH 1151))

CEE 3502 - Environmental Monitoring and Measurement Analysis

Introduction to environmental data acquisition and interpretation, fundamentals of environmental monitoring, instrumentation, measurement techniques, and statistical analyses. Measurements are conducted in a variety of engineered and natural environments. Probability and statistical analyses are applied to the collected data.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): MA 2160 and (CH 1150 and CH 1151)

CEE 3503 - Environmental Engineering

Application of fundamental chemical, biological, and physical principles of environmental engineering to design and operation of systems used for water and wastewater treatment, solid waste management, air pollution control, and analysis of quality of surface water, air, and groundwater.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 2160 and CH 1112 or (CH 1150 and CH 1151)

CEE 3620 - Water Resources Engineering

Introduction to hydrologic engineering, including rainfall-runoff modeling and hydrologic frequency analysis. Analysis and design of hydraulic systems such as pipe networks and storm water management systems. Computational, field, and experimental laboratory sessions reinforce lectures and provide hands-on learning opportunities.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (ENG 3200 or CEE 3200) and (MA 3710(C) or MA 2710(C) or MA 2720(C) or CEE 3502(C) or CEE 3710(C))

CEE 3710 - Uncertainty Analysis in Engineering

Introduction to probability, statistics, and uncertainty analysis with examples from civil engineering (e.g. models of vehicle arrivals, structural reliability, flood distributions). Topics include: discrete probability theory, probability distributions, parameter estimation, confidence intervals, hypothesis tests, linear regression, and model selection.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2160

CEE 3810 - Soil Mechanics for Engineers

Develops the terminology and descriptions common to the field. Studies soil compressibility, fluid flow, response to mechanical compaction, and strength as well as methods of determining geostatic stresses and stress changes due to boundary loadings. An experimental laboratory experience reinforces the lecture material.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): GE 2000(C) and (MEEM 2150 or ME 2150 or ENG 2120) and (ENG 3200 or CEE 3200 or GE 3850)

CEE 4020 - Digital Project Delivery

Problem-solving using industry standard software, such as Civil3D, is applied to civil and environmental engineering projects such as terrain modeling, earth work calculations, and road alignment. Concepts involving data management, data visualization, and risk analysis are introduced.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CEE 3332 or CEE 3401(C) or SU 2220

CEE 4030 - Building Information Modeling

Project-based learning will involve the use of industry BIM software, including Autodesk Revit and Navisworks. The focus will be on applying BIM to civil and construction engineering projects, such as building modeling, 4D visualization, and crash detections, with an emphasis on residential cases. BIM theories will also be introduced.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Major(s): Construction Management
Pre-Requisite(s): CEE 3332

CEE 4101 - Bituminous Materials

Applications and properties of asphalt binder, aggregates for bituminous mixtures, and analysis and design of asphalt concrete mixtures. Includes asphalt cement production, rheology, chemistry, and grading, aggregate grading and blending, and mixture design and characterization. Also discusses asphalt mixture production, construction, and recycling.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): CEE 3101

CEE 4201 - Matrix Structural Analysis

Analysis of trusses and frames by the direct stiffness method. Use of a typical commercial computer code is stressed as a tool for complex structures. Introduces three-dimensional structures.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CEE 3202

CEE 4213 - Structural Concrete Design

Introduction to design of reinforced concrete structural components. Analyze and design reinforced concrete beams, columns, and footings. Understand material behavior, limit state criteria, and practical detailing considerations. Application of the ACI 318 to cast-in-place and precast systems.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): CEE 3202

CEE 4223 - Steel Design I

Behavior and design of structural steel members using both ASD and LRDF approaches. Covers material behavior, external loads, and the design of tension, compression, and flexural members (rolled, built-up, and composite), and simple welded and bolted connections.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Summer
Pre-Requisite(s): CEE 3202

CEE 4233 - Structural Timber Design

Introduction to the use of wood as a structural engineering material. Includes design of beams, columns, nailed and bolted connections, trusses, and panels. Overview of engineered timber systems including glulam, LVLs, I-joists, and cross-laminated timber.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CEE 3202 or CMG 3250

CEE 4244 - Loads for Civil Structures

The course focuses on the theory and building code requirements for civil structural loadings that are used in design. The loads and load combinations will include dead loads, occupancy live loads, snow loads, wind loads, and seismic loads.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CEE 3202

CEE 4333 - Estimating and Planning of Construction Projects

Examination of the principles and techniques of estimating construction costs leading to the development of an estimate and proposal submission. The relationship between the contract specification, drawings, and the estimate will be illustrated.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): CEE 3332 or CMG 3265

CEE 4344 - Construction Scheduling

This course will introduce students to the basics of construction scheduling. Topics covered will include: Fundamentals of different scheduling methods such as Critical Path Method and linear scheduling, Resource allocation in schedules, and Schedule monitoring and control methods.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): CMG 3265 or CEE 3332

CEE 4401 - Pavement Design

Analysis, behavior, performance, and structural design of highway pavements. Introduces pavement types and performance concepts, highway traffic and subgrade characterization, materials employed in highway construction, and highway drainage. Presents common methods used for designing pavement structures as well as mechanistic- empirical approaches.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CEE 3401 and CEE 3101

CEE 4402 - Traffic Engineering

Introduction to traffic engineering, traffic characteristics, data collection techniques, capacity analysis, traffic control devices, intersection control, traffic signal systems, parking, and street operations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

CEE 4404 - Railroad Engineering

Rail transportation systems require infrastructure, vehicles, motive power and energy, and control systems to move goods and people. This multi-disciplinary course provides students with understanding of these system components and related engineering and technology enabling efficient operation of today's system.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

CEE 4406 - Airport Planning and Design

Introduction to the air transportation system, airport planning studies, demand forecasting, aircraft characteristics, runway requirements, airport layout and design. Also includes environmental impacts, airport capacity and operations, terminal and ground access planning and analysis.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

CEE 4407 - Transportation Design

Introduction to computer aided geometric design of highways and railways. Covers design principles and use of standards for horizontal and vertical alignments and cross sections, including road intersections, railway turnouts and grade crossings. Students develop engineering drawings and related cost estimates for road/rail project.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CEE 3401 and SU 2000

CEE 4410 - Transportation Planning

An introduction to urban transportation planning, planning data collection, transportation planning models, and development and evaluation of transportation plans. Includes extensive use of transportation planning software to evaluate transportation plans in multimodal networks.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

CEE 4501 - Environmental Engineering Chemical Processes

Application of chemistry, conservation principles, and mathematics to the analysis of chemical processes occurring in natural and engineered environments. Topics include acid-base phenomena, the carbonate system, precipitation/dissolution, redox chemistry, diffusion, mass transfer, and applications to engineering design.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): (CEE 3501 or CEE 3503) and CEE 3502 and (ENG 3200 or CEE 3200)

CEE 4502 - Wastewater Treatment Principles and Design

Principles of physical, chemical, and biological processes employed in wastewater treatment. Design of selected individual units within wastewater treatment systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CEE 3501 or CEE 3503

CEE 4503 - Drinking Water Treatment Principles and Design

Provides an overview of the principles and design of municipal water treatment practices. Understand the physical and chemical processes employed in water treatment. Design individual unit processes with a view toward integration into complete treatment systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CEE 3501 or CEE 3503

CEE 4504 - Air Quality Engineering and Science

Overview of air quality regulation in the U.S. and world, including basic concepts of atmospheric chemistry and transport; fugitive, point, and area emissions; principles and tradeoffs of operation and design of air pollution control systems; and application of air quality models.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CEE 3501 or CEE 3503

CEE 4505 - Surface Water Quality Engineering

Develops the scientific basis for water quality management in lakes and rivers. Considers the origin, behavior, and fate of nutrients and toxic substances. Introduces engineered approaches for lake management, including mass balance modeling. Presents techniques for water quality restoration and the legal framework supporting pollution control.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Pre-Requisite(s): CEE 3501 or CEE 3503

CEE 4506 - Sustainable Engineering

Study of sustainability, engineering and design including systems analysis, life cycle analysis, biogeochemical cycles, energy balances, energy conservation and development, models for sustainable engineering, environmental regulations as sustainability instruments, sustainability in the build environment, and industrial ecology and compliance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CEE 3501 or CEE 3503

CEE 4507 - Water Distribution and Wastewater Collection

Application of basic principles in civil and environmental engineering to the analysis and design of water distribution systems, wastewater collection systems, and their appurtenances.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring
Pre-Requisite(s): (CEE 3501 or CEE 3503) and CEE 3620

CEE 4509 - Environmental Process & Simulation

Provides a rigorous hands-on introduction to process control, laboratory and pilot-plant experimentation focused on physical, chemical and biological treatment systems used in environmental engineering.
Credits: 2.0
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Spring
Pre-Requisite(s): (CEE 3501 or CEE 3503) and (ENG 3200 or CEE 3200) and (CEE 4502 or CEE 4503(C))

CEE 4510 - Baccalaureate Thesis

Independent baccalaureate research project performed under the supervision of one or more faculty.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

CEE 4511 - Solid and Hazardous Waste Engineering

Characterization, treatment, separation, and disposal of solid and hazardous wastes. Science and engineering for the management of solid and hazardous waste problems. Technologies discussed include incineration, landfilling, vapor extraction, soil washing, and bioremediation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CEE 3501 or CEE 3503

CEE 4518 - Aquatic Biogeochemistry

Covers interactions among chemical, biological, and physical processes within aquatic ecosystems as well as role of aquatic ecosystems in global biogeochemistry. Modeling as an integrative tool is stressed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CEE 4501(C) and CEE 4505(C)

CEE 4521 - Bioremediation Engineering

Introduction to the microbiological and engineering fundamentals of bioremediation. Topics include relevant microbial biochemistry, physiology, and ecology; necessary site data; design and operation of current and emerging bioremediation systems; monitoring methods for bioremediations projects; and technical evaluation of selected case studies.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (CEE 3501 or CEE 3503) and BL 3310

CEE 4528 - Global Biogeochemistry

This course gives an overview of important biogeochemical processes occurring in land, air, and water. An emphasis is put on modeling as an integrating tool.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CEE 4501(C)

CEE 4610 - Water Resources System Modeling & Design

Solve complicated, open-ended real-world water resources problems in natural and built systems by developing and executing models using state of the practice technologies. Includes programming to manage large datasets and validation or calibration and optimization of models for design.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CEE 3620 or CEE 3650

CEE 4620 - River and Floodplain Hydraulics

Analysis and modeling strategies of open channel systems, including natural channels, designed channels, flow transitions, non-uniform flow, and unsteady flow.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CEE 3620

CEE 4640 - Stormwater Management and Low Impact Development

Design techniques for stormwater collection, conveyance, infiltration, and detention storage systems are discussed, both traditional stormwater management systems and newer approaches based on the philosophy of low impact development (LID) that seek not to alter the natural ecology of a site.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Summer
Pre-Requisite(s): CEE 3620

CEE 4650 - Hydraulic Structures

Application of basic principles fluid mechanics in civil and environmental engineering to the analysis and design of hydraulic structures.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CEE 3620(C)

CEE 4665 - Stream Restoration

Basic mechanics of the transport of sediments in natural systems, including tractive forces and geomorphic functions.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CEE 3620

CEE 4760 - Optimization Methods in Civil and Environmental Engineering

Decision analysis and optimization techniques, including linear programming, nonlinear programming, and dynamic programming. Computer-based solutions of design problems in various civil and environmental engineering specialty areas are considered.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MA 2160 and (MA 2320 or MA 2321 or MA 2330)

CEE 4820 - Foundation Engineering

This course is designed to provide students in civil engineering with methods of analysis and design for various geotechnical systems. Topics to be covered include subsurface investigations, footings, pile foundations and drilled shafts, earth pressure theories, retaining walls, and slope stability analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CEE 3810

CEE 4830 - Geosynthetics Engineering

Geosynthetic materials are grouped by mechanical characteristics and engineering use. They are widely used in highway, landfill, and embankment design. Develop designs for filters, soil separators, reinforced earth, and impermeable membranes. Also learn when using a geotextile is appropriate.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): CEE 3810

CEE 4850 - Rock Engineering for Civil Engineers

This course focuses on the applied behavior of rock encountered primarily in civil engineering projects. Topics include rock classification, rock durability, rock mass strength classification, use of stereo nets, rock reinforcement, blasting, rock socket application and bearing capacity on rock.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CEE 3810(C)

CEE 4900 - Engineering Design Project I

An engineering design project related to civil and environmental engineering. Not available to students who have taken CE4905. Students must complete both CE4900 and CE4910 to fulfill senior design requirements. Must be senior project ready as defined by major department.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

CEE 4905 - Engineering Design Project

An engineering design project related to civil and environmental engineering. Not available to students who have taken CE4900 or CE4910. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

CEE 4910 - Engineering Design Project II

Continuation of CE4900. Not available to students who have taken CE4905. Students must complete both CE4900 and CE4910 to fulfill senior design requirements. Senior project ready as defined by major substitutes for prerequisites.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring, Summer
Pre-Requisite(s): CE 4900 or CEE 4900

CEE 4915 - International Engineering Field Experience

An engineering design project that incorporates an international experience. Must be taken in conjunction with CE4916 in order to fulfill senior design requirements. Must be senior project ready as defined by major department.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Senior

CEE 4916 - International Senior Design Field Project

An engineering design project that incorporates an international experience. Must be taken in conjunction with CE4915 in order to fulfill senior design requirements. Senior project ready as defined by major substitutes for prerequisites.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): CE 4915 or CEE 4915

CEE 4920 - Civil Engineering Independent Study

Approved research or design project in civil engineering, originating with an individual student or assigned by the instructor.
Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

CEE 4930 - Environmental Engineering Independent Study

Approved research or design project in environmental engineering, originating with an individual student or assigned by the instructor.
Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

CEE 4990 - Special Topics in Civil and Environmental Engineering

Topics of special interest in civil or environmental engineering.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer

CEE 4993 - Engineering with Developing Communities

Study of applying appropriate, community-based, and sustainable engineering in developing communities. Concepts of human-centered design and sustainable development are covered. Topics are drawn from several areas of engineering, including water and wastewater treatment, construction materials, solid waste, energy, and information systems.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall
Pre-Requisite(s): BE 3350 or CM 3110 or ENG 3200 or MEEM 3201 or CEE 3200

Chemistry

CH 1000 - Introductory Chemistry

Introduces fundamental concepts of chemistry to students who are interested in how chemical processes shape the world. Covers fundamental chemical concepts and integrates applications of chemistry that are relevant to the global community. High school chemistry is not required.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

CH 1134 - Professional Development Seminar for Chemists I

Course provides an introduction to the Chemistry. Broad topics encompass: acclimating and thriving in the University setting including; understanding college expectations, career preparation and planning, time and stress management, information literacy, technical communication, and opportunities within chemistry.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

CH 1150 - University Chemistry I

Introduces the foundations of chemistry, including electronic structure of atoms and molecules, intermolecular forces, states of matter, chemical reactions, organic chemistry, chemical equilibria, kinetics, and acid-base chemistry. Includes laboratory component that emphasizes lecture components.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1151
Pre-Requisite(s): MA 1031(C) or MA 1032(C) or MA 1120(C) or MA 1160(C) or MA 1161(C) or MA 1135(C) or MA 1121(C) or ALEKS Math Placement >= 61 or CEEB Calculus AB >= 2 or CEEB Calculus BC >= 2 or CEEB Calculus AB Subscore >= 2 or ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540

CH 1151 - University Chemistry Lab I

Laboratory to accompany CH1150.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1150
Pre-Requisite(s): MA 1031(C) or MA 1032(C) or MA 1120(C) or MA 1160(C) or MA 1161(C) or MA 1135(C) or MA 1121(C) or ALEKS Math Placement >= 61 or CEEB Calculus AB >= 2 or CEEB Calculus BC >= 2 or CEEB Calculus AB Subscore >= 2 or ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540

CH 1153 - University Chem Recitation I

Problem solving session to support University Chemistry I - CH1150.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1150
Pre-Requisite(s): MA 1031(C) or MA 1032(C) or MA 1120(C) or MA 1160(C) or MA 1161(C) or MA 1121(C) or MA 1135(C) or ALEKS Math Placement >= 56 or CEEB Calculus AB >= 2 or CEEB Calculus BC >= 2 or CEEB Calculus AB Subscore >= 2 or ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540

CH 1160 - University Chemistry II

A continuation of CH 1150. Introduces more complex concepts in chemistry, including kinetics, chemical equilibria, acid-base equilibria, thermodynamics, electrochemistry, and chemical analysis. Additional topics may include chemistry of the metals and non-metals, biochemical systems, and nuclear chemistry. Includes laboratory component that emphasizes lecture concepts.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1161
Pre-Requisite(s): CH 1112 or (CH 1150 and CH 1151)

CH 1161 - University Chemistry Laboratory II

Laboratory to accompany CH1160.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1160
Pre-Requisite(s): CH 1112 or (CH 1150 and CH 1151)

CH 1163 - Problem Solving in University Chemistry II - CH1160

Problem solving session to support University Chemistry II - CH1160.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): CH 1160
Pre-Requisite(s): CH 1150 and CH 1151

CH 2130 - Professional Development for Chemists 2

Continuation from CH1130 and provides a more in-depth review of topics related to career planning, such as resume writing, interviewing, selecting research topics, research integrity, reading and writing reports, applying for scholarships and grants, and oral communication skills.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Comp Chemistry & Chem Infrmtcs, Biochem & Molec Biology-Chem, Cheminformatics, Pharmaceutical Chemistry, Medicinal Chemistry, Chemistry (BA), Chemistry
Pre-Requisite(s): CH 1130 or CH 1134

CH 2410 - Organic Chemistry I

A study of the chemistry of carbon compounds. Review of hybrid orbitals, covalent bonding, and resonance. Introduction to nomenclature, stereochemistry, mass spectrometry and infrared spectroscopy, functional group chemistry based on reaction mechanisms, and multi-step synthesis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

CH 2411 - Organic Chemistry Lab I

Laboratory to accompany CH2410.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Summer
Pre-Requisite(s): (CH 2410(C) or CH 2430(C)) and CH 1122 or (CH 1160 and CH 1161)

CH 2420 - Organic Chemistry II

Covers more functional group chemistry based on reaction mechanisms; more involved multi-step synthesis; introduction to nuclear magnetic resonance spectroscopy; introduction to carbohydrates, amino acids, proteins, nucleic acids; and topics of specialized interest.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): CH 2410

CH 2421 - Organic Chemistry Lab II

Laboratory to accompany CH2420.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring, Summer
Pre-Requisite(s): CH 2411 and (CH 2420(C) or CH 2440(C))

CH 2430 - Mechanistic Organic Chemistry

This course is an introduction to organic chemistry focusing on providing the understanding of chemical reactivity of various types of organic molecules through a mechanistic perspective. The emphasis is given to mastering substitution, elimination, and addition mechanisms and their relevance to various kinds of organic compounds
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Co-Requisite(s): CH 2411
Pre-Requisite(s): CH 1160 and CH 1161

CH 2440 - Synthetic Organic Chemistry

The course focuses on the methods used to identify the structure of organic molecules, advanced principles of organic stereochemistry, and methods used for the synthesis of complex organic compounds with examples of biological and pharmacological applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 2430

CH 2590 - The Chemistry of Color and Art Materials

Explore the chemistry behind color and art materials. Topics include light and color perception, historical pigments, synthetic colorants, paint composition, and art conservation. Investigate how chemistry shapes both the creation and preservation of paintings, with cultural and historical perspectives.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

CH 2710 - Introduction in Computational Chemistry and Chemical Informatics

This course is designed for students without prior knowledge of the subject. It introduces the use of computers in modern chemistry through lectures on principles of computational chemistry and practical hands on sessions with computational experiments in organic, inorganic, and biochemistry.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): CH 1160

CH 2990 - Exploring Undergraduate Research in Chemistry

An elective course for students who want to pursue chemistry research early in their academic career or may be uncertain of their research interests. One credit translates to three hours of commitment per week. Projects may require an additional semester to complete.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1150(C) and CH 1151(C)

CH 3020 - Laboratory Teaching Internship

Requires teaching a section of undergraduate laboratory under professional supervision. Emphasizes communicating good laboratory practice and technique to beginning students as well as maintaining a safe working environment. Includes safety training and teaching orientation.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

CH 3124 - Communication for the Chemical Sciences

The course will review different forms of scientific information presented in both professional and popular media, cover scientific writing styles, learn effective presentation of graphical information. Students will learn a variety of methods of professional presentation of scientific results and technical information.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

CH 3130 - Professional Development for Chemists 3

Continuation from CH2130 and provides a more in-depth review of topics related to refining written and oral communication skills, including advanced library resources, reading and writing reports, and seminar attendance.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Comp Chemistry & Chem Infrmtcs, Biochem & Molec Biology-Chem, Cheminformatics, Pharmaceutical Chemistry, Medicinal Chemistry, Chemistry (BA), Chemistry
Pre-Requisite(s): CH 2130

CH 3200 - Chemistry and Biology of Brewing

This course is designed to expose science majors to various analytical techniques and instrumental methods used in chemistry and biology. Students will engage in numerous applications of basic chemical and biological concepts in the context of beer brewing, a complex and multifaceted biochemical system.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Spring
Pre-Requisite(s): CH 1150 and CH 1151

CH 3310 - Analytical Chemistry I

This course covers quantitative analytical chemistry, emphasizing gravimetric, volumetric, spectrophotometric, and potentiometric methods. Key topics include chemical equilibrium, titrations, electrochemistry, separations, and spectrophotometry for chemical analysis and problem-solving.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Co-Requisite(s): CH 3311
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

CH 3311 - Analytical Chemistry I Lab

This laboratory course complements the lecture by providing hands-on experience in gravimetric, volumetric, spectrophotometric, and potentiometric techniques. Students will conduct experiments to apply quantitative methods for chemical analysis, focusing on accuracy, precision, and data interpretation.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall
Co-Requisite(s): CH 3310
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

CH 3320 - Analytical Chemistry II

This course explores advanced instrumental methods for chemical analysis. Topics include mass spectrometry, atomic spectroscopy, advanced separations, electroanalytical techniques, instrumental electronics, optics, and surface analysis. Emphasis is placed on data accuracy, precision, and the application of instrumentation in chemical analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 3310 and CH 3510(C)

CH 3321 - Analytical Chemistry II Lab

This laboratory course complements the lecture by providing hands-on experience in gravimetric, volumetric, spectrophotometric, and potentiometric techniques. Students will conduct experiments to apply quantitative methods for chemical analysis, focusing on accuracy, precision, and data interpretation.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Co-Requisite(s): CH 3320
Pre-Requisite(s): CH 3310 and CH 3511(C)

CH 3500 - Physical Chemistry for Environmental and Life Sciences

Equilibrium thermodynamics, chemical kinetics, transport properties, gas laws, and phase equilibria with an emphasis on solution behavior and applications to molecules important in the environmental and life sciences.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Chemistry, Chemical Engineering
Pre-Requisite(s): CH 1160 and CH 1161

CH 3505 - Mathematics for Applications in Physical Chemistry

Emphasis on practical use of mathematical concepts necessary for Physical Chemistry. Topics include: vectors, single- and multi-variable functions, integrals, power series, ordinary differential equations.
Credits: 1.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Summer
Pre-Requisite(s): CH 1150 and MA 2160

CH 3510 - Physical Chemistry I - Thermodynamics, Equilibrium and Kinetics

Ideal and non-ideal gas laws, the kinetic theory of gases, equations of state, liquid-vapor equilibrium, the laws of thermodynamics, solid-liquid-vapor equilibria, the chemical potential, chemical equilibrium, electrochemistry, the phase rule, phase diagrams, and chemical kinetics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161) and MA 2160 and (PH 2200(C) or PH 2260(C))

CH 3511 - Physical Chemistry Lab I

Laboratory to supplement CH3510.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CH 3510(C)

CH 3520 - Physical Chemistry II - Molecular Structure

Continuation of CH3510. Covers solid-state chemistry, surface chemistry, atomic and molecular spectroscopy and structure, chemical applications of group theory, valence, the periodic table, elements of quantum mechanics, and statistical thermodynamics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161) and MA 3160 and PH 2200(C)

CH 3521 - Physical Chemistry Lab II

Laboratory to supplement CH3520.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Pre-Requisite(s): CH 3520(C)

CH 3540 - Biophysical Chemistry

Examines fundamental physical principles underlying complex biological systems in order to understand the interactions and behaviors found in biological, biochemical, and physical systems. Topics include macromolecules in aqueous environments, spectroscopy and structure determination, kinetics, membranes, and transport phenomena.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): BL 1020 or BL 1040 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410) and CH 1122 or (CH 1160 and CH 1161) and MA 2160 and PH 2200

CH 3541 - Biophysical Chemistry Laboratory

Examines the physical methods employed in the study of biological systems, including structure determination, spectroscopy, microscopy, imaging, and modeling. The core objective is application of the fundamentals developed in the Biophysical Chemistry course to systems of biological relevance.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Pre-Requisite(s): CH 3540(C)

CH 4110 - Medicinal Chemistry: Mechanism of Drug Action

Focuses on structural and mechanistic approaches to pharmaceuticals and drug action. General principles of absorption, distribution, action, metabolism and toxicity of drugs will be presented followed by action of drug classes such as antibiotics, cardiovascular, and anti-inflammatory drugs.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): CH 2410 or CH 2430

CH 4120 - Medicinal Chemistry: Drug Design

Focuses on the important concepts in the design and synthesis of drugs. Rational basis for drug design including synthetic, computational and biochemical concepts will be discussed. Topics include structure-activity relationships, synthesis and reaction mechanism, and case studies of drugs.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): CH 2420 or CH 2440

CH 4130 - Professional Development for Chemists 4

Continuation from CH3130 with emphasis on advanced topics of written and oral communication skills.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Chemistry, Biochem & Molec Biology-Chem, Pharmaceutical Chemistry, Medicinal Chemistry, Comp Chemistry & Chem Infrmtcs, Cheminformatics
Pre-Requisite(s): CH 3130

CH 4140 - Introduction to Pharmaceutical Analysis

This course will present a systematic introduction to chemical analysis of pharmaceutical raw materials, finished pharmaceutical products, and of drugs in biological fluids, which are carried out in pharmaceutical laboratories worldwide.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): CH 2410 or CH 2430

CH 4210 - Instrumental Analysis

The lecture portion of CH4212; not open to undergraduate chemistry majors.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 2212 and CH 2210 and CH 2211 and CH 3510(C) and CH 3511(C)

CH 4211 - Instrumental Analysis Lab

Chemical analysis and instrumentation applies to organic and inorganic analyses.
Credits: 2.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): CH 3510(C) and CH 3511(C) and CH 4210(C) and (CH 2210 and CH 2211 or CH 2212)

CH 4220 - Bioanalytical Chemistry

This course provides an overview of modern analytical and instrumental techniques with an emphasis on the approaches relevant to common techniques for biochemistry.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161) and (CH 3510(C) and CH 3511(C))

CH 4221 - Bioanalytical Chemistry Lab

This lab provides an overview of modern analytical and instrumental techniques with an emphasis on the approaches relevant to common techniques for biochemistry.
Credits: 2.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161) and (CH 3510(C) and CH 3511(C)) and CH 4220(C)

CH 4240 - Advanced Mass Spectrometry

Advanced instrumentation and methods are the focus of this course. Design of various mass analyzers and their advantages and limitations will be reviewed. Advanced identification methods such as tandem mass spectrometric analysis and exact mass analysis will be discussed.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 4212 or (CH 4210 and CH 4211) or CH 4222 or (CH 4220 and CH 4221)

CH 4241 - Advanced Mass Spectrometry Laboratory

Students will learn how to perform mass spectrometry (MS) experiments to identify and quantify molecules. The experiments will include the following method approaches: electrospray ionization (ESI), matrix associated laser desorption (MALDI) and tandem MA analysis (MS/MS).
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Co-Requisite(s): CH 4240
Pre-Requisite(s): CH 4212 or (CH 4210 and CH 4211) or CH 4222 or (CH 4220 and CH 4221)

CH 4310 - Inorganic Chemistry I

Descriptive chemistry of the main group elements with some emphasis on the structure and theory of bonding with transition metal complexes. Examines bonding, physical and chemical properties, structure, and reactions of the chemical elements and their compounds.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 3520

CH 4311 - Inorganic Chemistry Laboratory

Laboratory preparations (selected inorganic and organometallic compounds) that illustrate appropriate experimental techniques for synthesis of molecules; measurement of chemical properties, structures, and phenomena; hands-on experience with modern instrumentation; computational data analysis (by means of single crystal X-ray Diffraction experiments).
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall
Pre-Requisite(s): CH 4310(C)

CH 4320 - Inorganic Chemistry II

Continuation of CH4310. Descriptive chemistry of the transition group elements. Transition metal compounds; aspects of bonding, spectra, and reactivity; complexes of p-acceptor ligands; organometallic compounds and their role in catalysis; metals in biological systems; preparative, analytical, and instrumental techniques.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 4310

CH 4330 - Bioinorganic Chemistry

The course focuses on the recent advances in Bioinorganic Chemistry and in particular the role of metals in biochemistry. The course explores the methods for studying of bioinorganic enzymes and will focus on the roles of different main group and transition metals in proteins, enzymes and nucleic acids.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 4710 or BL 3020 or CH 4110

CH 4412 - Spectroscopy of Organic Chemistry

Emphasizes use of spectral data interpretation to determine structures of organic compounds. Discusses proton and carbon nuclear magnetic resonance (including two- dimensional techniques, COSY, HETCOR, etc.), mass spectrometry, infrared spectrophotometry.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): CH 2420 or CH 2440

CH 4430 - Intermediate Organic Chemistry

Develop the chemical intuition necessary for advanced work in organic chemistry. Emphasizes reaction mechanisms and why reactions occur. Topics include heteroaromatic chemistry, curved-arrow formalism and multi-step reactions, molecular orbitals and symmetry-controlled reactions, Hammett equation and structure-activity relationships, substitution reactions and carbonyl reactions.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 2420 or CH 2440

CH 4440 - Molecular Modeling

The course focuses on the principles and applications of the methods for molecular modeling of large molecules. The students will learn the principles of molecular mechanics (MM), molecular dynamics (MD), combined quantum mechanics and molecular mechanics (QM/MM) and their applications for understanding molecular and biomolecular systems.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): CH 3510 and CH 2510

CH 4515 - Atmospheric Chemistry

Study of the photochemical processes governing the composition of the troposphere and stratosphere, with application to air pollution and climate change. Covers radical chain reaction cycles, heterogeneous chemistry, atmospheric radiative transfer, and measurement techniques for atmospheric gases.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): CH 3510 or CH 3520(C) or ENVE 4501 or ENVE 4504 or CEE 4501 or CEE 4504

CH 4535 - Physical Chemistry III - Molecular Driving Forces from Fundamentals to Applications

Advance course design to bridge concepts in thermodynamics, kinetics, and quantum chemistry through the application of statistical mechanics to understand the molecular driving forces acting in chemical/physical/material/biological systems at both microscopic, and macroscopic level.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): CH 3510 and CH 3520

CH 4560 - Computational Chemistry

Focuses on the theory and method of modern computational techniques applied to the study of molecular properties and reactivity through lecture and computer projects. Covers classical mechanical as well as quantum mechanical approaches.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): CH 3520

CH 4610 - Introduction to Polymer Science

Introductory study of the properties of polymers. Includes structure and characterization of polymers in the solid state, in solution, and as melts. Topics include viscoelasticity, rubbery elasticity, rheology and polymer processing. Applications discussed include coatings, adhesives, and composites.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

CH 4620 - Polymer Chemistry

Study of polymer chemistry dealing with the mechanisms of polymerization and copolymerization. Study of the chemistry of polymers, including polymer modification and degradation. Topics include methods for measuring and predicting the path of degradation and stabilization.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 2420 or CH 2440

CH 4710 - Biomolecular Chemistry I

Examines chemical concepts underlying biomolecules and bioprocesses and interconnections between biology and chemistry. Bioorganic mechanisms and biophysical concepts in biochemistry are emphasized. Topics include biomolecules including proteins and nucleic acids and bioprocesses including catalysis and gene action.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 2420 or CH 2440

CH 4720 - Biomolecular Chemistry II

Focuses on structural and chemical logic of bioprocesses with emphasis on bioorganic mechanisms and the interconnections between biology and chemistry. Topics include metabolic pathways, membrane biophysics, ion-channels, cell communication, transcriptional control and molecular biology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 3020 or CH 4710

CH 4721 - Research Methods in Biomolecular Chemistry

Lab course will emphasize the research process in biomolecular chemistry by actively involving students in question formulation, experimental design, data gathering, critical analysis, teamwork, and communication in an inquiry-based format. Students will employ methods used in modern biochemistry/molecular biology in a series of open-ended experiments that will lead to a student-developed original research project.
Credits: 3.0
Lec-Rec-Lab: (0-0-7)
Semesters Offered: Spring
Pre-Requisite(s): CH 4710 and CH 4222 or (CH 4220 and CH 4221) or CH 4212 or (CH 4220 and CH 4211) and CH 4720

CH 4800 - Current Topics in Undergraduate Chemistry

Covers chemistry topics not included in regular courses. Topics may include designing organic syntheses, heterogeneous catalysis, homogeneous catalysis, solid-state chemistry, and heterocyclic chemistry.
Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand

CH 4820 - Undergraduate Independent Study in Chemistry

Individualized course designed to integrate academic and professional interests to foster student's career goals. Student will provide or work with a faculty member to identify an area of interest. Experience will enhance a student's content knowledge on a selected topic and/or provide project-based learning.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CH 4990 - Undergraduate Research in Chemistry

An undergraduate research experience in which students select a literature and laboratory research problem and write a report on the work performed. The student typically signs up for 1 to 3 credits per semester; most problems require more than one semester to complete. Requires GPA of 2.50 or better.
Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

CH 4995 - Undergrad Research in Biochem

Undergraduate research experience in Biochemistry where students work on independent research projects under the direction of biochemistry faculty performing research in areas of biophysics, biochemistry, and molecular biology. Instructor permission required.
Credits: variable to 6.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

Chemical Engineering

CM 1000 - Introduction to Chemical Engineering

Introduces chemical engineering as a profession using the theme of industrial chemical production. Covered concepts include process flow diagrams, unit operations, green engineering, and career opportunities. Guest speakers from industry will provide their perspectives on working as a chemical engineer.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

CM 2110 - Material and Energy Balances

Application of material and energy balances to chemical processes. Fundamental concepts covered include: process flow diagrams, engineering charts and tables, vapor-liquid equilibrium, and stoichiometry.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): (MA 1160 or MA 1161 or MA 1135 or MA 1121) and (CH 1112 or (CH 1150 and CH 1151))

CM 2200 - Intro Minerals and Materials

Fundamentals of minerals processing, raw materials production, and extractive metallurgy, including primary metals production.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

CM 3025 - Bioprocessing Laboratory

Experience all steps involved in manufacturing a product using microorganisms. Learn and apply molecular biology and microbial characterization techniques, perform microbial cell culture to generate a product, employ downstream separations for product recovery and purification, and analyze product purity and yield.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): CH 1112 or (CH 1150 and CH 1151)

CM 3110 - Transport Phenomena and Unit Operations I

Introduce and apply concepts of momentum transfer (fluid mechanics) and heat transfer to unit operations. Presents the basic equations of momentum and heat transfer by conduction and radiation, along with transport equations that can be used in engineering analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CM 2110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160 and PH 2100

CM 3120 - Transport Phenomena and Unit Operations II

Introduce and apply concepts of convective heat transfer and mass transfer to unit operations. Presents the basic equations of mass and heat transfer, mass transfer analogies, and combines transport equations for use in engineering analysis.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 3110 and CM 3230

CM 3215 - Chemical Engineering Fundamentals Laboratory

This course is an introduction to basic laboratory methods and instrumentation used in chemical engineering including measurement of fluid flow, heat transfer, and mass transfer. Topics include statistical data analysis, experimental design, principles of measurement and instrumentation, and technical communication.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 3110(C) and UN 1015

CM 3230 - Thermodynamics for Chemical Engineers

First and second law applied to closed and open systems. Topics include energy conservation, heat cycles, entropy and enthalpy calculations on engineering systems; property estimation for pure components and mixture constituents, and multicomponent phase equilibria.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CM 2110 and MA 2160 and PH 2100

CM 3240 - Stagewise Separation Processes

This course will relate thermodynamic principles to separation processes. Mass balances, energy balances, and other fundamental concepts are applied in selected equilibrium stagewise and rate-based material multiphase separations (distillation, absorption, stripping, extraction, washing, packed bed, membrane-based, and leaching operations).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CM 3230 and MA 2160

CM 3310 - Process Control

Covers methods of analyzing the transient behavior of chemical processing systems and components, the design and tuning of feedback controllers, and an introduction to industrial automation for batch processes. Laboratory introduces data acquisition and implementation of feedback control.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and PH 2200 and CM 2110

CM 3450 - Computer-Aided Problem Solving in Chemical Engineering

The use of modern software packages in chemical engineering. Packages include spreadsheet, symbolic manipulator, chemical process calculator, statistical and modeling software. Course develops knowledge and skills in using computer tools that will complement chemical engineering courses and practice.
Credits: 3.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall
Pre-Requisite(s): CM 2110(C) and MA 2160

CM 3510 - Chemical Reaction Engineering

A study of chemical reaction engineering including design and analysis of chemical reactors, the fundamentals of chemical kinetics, and analysis of reaction rate data.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CM 2110 and CM 3110 and CM 3230 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

CM 3830 - Mineral Processing and Extraction Laboratory

Laboratory course covering the major mineral processing and extractive metallurgy operations, such as crushing, grinding, sampling, particulate separation processes, dewatering, and hydrometallurgical processing.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): CM 2200(C) or CM 2110(C)

CM 3979 - Alternative Energy Technologies and Processes

This course covers a wide range of alternative energy technologies with an emphasis on chemical and biochemical processing. Technologies covered may include biofuels, solar power, fuel cells, etc.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

CM 3980 - Sustainable Chemical Engineering

Fundamentals of global sustainability for chemical engineering and industrial processes. Includes fundamentals of sustainability, environmental issues and regulations, principles of green chemistry/engineering, environmental fate and transport of pollutants, life cycle assessment, and ethical, cultural, and environmental implications of decisions.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CM 2110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

CM 4000 - Chemical Engineering Research

An undergraduate research experience on chemical engineering topics. Students work directly with faculty members on a research project. A report (written, poster, or oral) may be required.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Level(s): Graduate

CM 4020 - Undergraduate Research in Mineral Processing Engineering

An undergraduate research experience on mineral processing engineering topics. Students work directly with faculty members on a research project. A report (written, poster, or oral) may be required.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Level(s): Graduate

CM 4040 - Undergraduate Research in Biological Engineering

An undergraduate research experience on biological engineering topics, excluding biofuels. Students work directly with faculty members on a research project. A report (written, poster, or oral) may be required.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Level(s): Graduate

CM 4060 - Undergraduate Research in Polymer Engineering

An undergraduate research experience on polymer engineering topics. Students work directly with faculty members on a research project. A report (written, poster, or oral) may be required.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Level(s): Graduate

CM 4080 - Undergraduate Research in BioFuels Engineering

An undergraduate research experience on bio-fuels engineering topics. Students work directly with faculty members on a research project. A report (written, poster, or oral) may be required.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Level(s): Graduate

CM 4110 - Unit and Plant Operations Laboratory I

A capstone laboratory course that provides a rigorous introduction to experiments focused in the unit operations of fluid mechanics, heat transfer, mass transfer, and chemical reaction engineering, as well as operation of a pilot plant.
Credits: 3.0
Lec-Rec-Lab: (0-0-9)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 3120 and CM 3215 and (CM 3240 or CM 2120) and CM 3310 and CM 3510 and CM 4320(C)

CM 4120 - Unit and Plant Operations Laboratory II

A capstone laboratory course that builds upon the skills introduced in CM4110 by operating and analyzing unit and plant scale experiments. Safety, process control, teamwork, and communication skills are stressed.
Credits: 3.0
Lec-Rec-Lab: (0-0-9)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate; Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 4110

CM 4320 - Chemical Process Safety

A study of the technical fundamentals of chemical process safety. Includes toxicology, industrial hygiene, source models, fires and explosions, relief systems, hazard identification, and risk assessment.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CM 3120 and CM 3230 and CM 3510

CM 4505 - Particle Technology

Fundamentals of particle processing, characterization, and separation. Topics include fine particle synthesis, mineral processing, automobile recycling, contaminated soils, recyclable materials such as batteries and tires, and sludges. Covers zeta potential, particulate surface chemistry, flocculation, and dispersion.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years

CM 4510 - Interfacial Engineering

Examines the physics and chemistry of interfaces, and the relevance of these principles in mineral processing, petroleum, water treatment, and other engineering applications. May include liquid surfaces, electric double layer, surface forces, contact angle phenomena, surfactants, adsorption, surface energy, emulsions.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): CH 3510 or CM 3230

CM 4610 - Introduction to Polymer Science

Introductory study of the properties of polymers. Includes structure and characterization of polymers in the solid state, in solution, and as melts. Topics include viscoelasticity, rubbery elasticity, rheology and polymer processing. Applications discussed include coatings, adhesives, and composites.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

CM 4620 - Polymer Chemistry

Study of polymer chemistry dealing with the mechanisms of polymerization and copolymerization. Study of the chemistry of polymers, including polymer modification and degradation. Topics include methods of measuring and predicting the path of degradation and stabilization.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 2420

CM 4710 - Biochemical Processes

Introduction to fundamental and applied industrial biochemical processing. Topics may include basic cell and genetic design, enzymes, metabolism, bioreactor analysis and design, bioseparations and industrial applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 2410

CM 4740 - Hydrometallurgy/Pyrometallurgy

Extraction and refining of metals and industrial chemicals from natural and recycled materials. Includes solution- chemistry processes (hydrometallurgy) and thermochemical processes (pyrometallurgy).
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1150

CM 4780 - Biomanufacturing and Biosafety

This course will give students additional tools to perform as an engineer in a biomanufacturing facility. Focus is on mammalian cell culture derived products. Federal laws and compliance of biosafety in manufacturing facilities. Process design software will be introduced.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BL 3020 or BL 3025 or CH 4710 or CM 4040 or CM 4080 or CM 4710 or (CM 3110(C) and BL 1400) or (CM 3110(C) and BL 1200)

CM 4855 - Process Analysis & Design I

Capstone technical and economic evaluations of processes and unit operations. Application of cost estimation, energy efficiency, and economic evaluation techniques. Teams analyze an existing facility, identify improvement opportunities, demonstrate the economic consequences, and recommend a course of action.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 3120 and CM 3215 and (CM 3240 or CM 2120) and CM 3510 and CH 2410 and CM 3980(C)

CM 4860 - Process Analysis & Design II

Process and project design principles applied to realistic problems, including project evaluation and management. Problems include safety, environmental, and operability constraints. Emphasizes the profit motive in industry and the role of the chemical engineer.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 4855 and CM 3980

CM 4861 - Capstone Design Project

Team projects to optimize designs for new ventures with realistic constraints. Requires process synthesis, market research, economic evaluation, and risk analysis techniques. Develops skills in problem solving, critical thinking, and communication.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Chemical Engineering
Pre-Requisite(s): CM 4860(C) and CM 3980

CM 4900 - Interdisciplinary Design 1

Focuses on an interdisciplinary chemical engineering design project. (Senior project ready as defined by major substitutes for prerequisites)
Credits: variable to 3.0
Semesters Offered: Fall
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

CM 4910 - Interdisciplinary Design 2

Focuses on an interdisciplinary chemical engineering design project. (Senior project ready as defined by major substitutes for prerequisites)
Credits: variable to 3.0
Semesters Offered: Spring
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

CM 4990 - Special Topics in CM

Covers chemical engineering topics not included in regular courses, which may include biochemical engineering, design of biochemical reactions, composite materials, and numerical analysis of transport processes.
Credits: variable to 3.0; Repeatable to a Max of 12
Semesters Offered: On Demand
Restrictions: Permission of instructor required

Construction Management

CMG 1000 - Introduction to Construction Management

Introduction to the construction management profession, and current issues and trends in residential and commercial construction industries. Focuses on how the construction industry works, along with enhancing verbal, CAD, and print reading skills.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

CMG 1000T - Transfer Non-Seminar

Credits: 2.0
Semesters Offered: On Demand
CMG 1200 - Introduction to Building Information Modeling
An introduction to Building Information Modeling (BIM) with an emphasis on the Autodesk Revit software.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring

CMG 2110 - Building Utility Systems

Overview of the mechanical, electrical, and plumbing components of building systems. HVAC systems and controls, water supply and drainage, electrical power distribution and lighting, fire detection, alarm, and communications. Includes construction drawing interpretation and design projects.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): PH 1240(C)

CMG 2120 - Statics and Strengths of Materials for Construction

Composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, centroids, and moments of inertia. Mechanical behavior of materials, including calculation of stresses, strains, and deformations due to axial, torsional, and flexural loading.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): PH 1110 or PH 1140

CMG 2140 - Building Materials & Methods

Materials, structural systems, building codes, and management procedures appropriate for residential and commercial construction. Includes construction drawing interpretation and graphic design project.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring

CMG 2265 - Construction Quantity Survey

An introduction to the interpretation of construction drawings to perform quantity take-offs. Emphasis is on the civil and architectural components of building construction, with some discussion of other elements.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CMG 1000

CMG 3200 - Site Planning and Development

An examination of land development issues including: site analysis, environmental concerns, contouring, earthwork and grading, soils, route alignments, storm water management, sewer systems, zoning, and land planning. Incorporates CAD applications in the lab.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 2000

CMG 3250 - Structural Analysis and Design

Elastic theory analysis and design of steel structural components, including tension, compression, truss frames, flexural beams, and connections. Includes an introduction to reinforced concrete structures and timber. All work is according to current applicable code manuals. Design projects include computer applications.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 2120 or ENG 2120 or MEEM 2150

CMG 3265 - Construction Cost Estimating

Advanced study of construction cost estimating topics. Includes conceptual estimating, unit price development, subcontract work, budgets, negotiated contracts, and related items. Extensive use of spreadsheets and estimating.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 2265 or CEE 3332

CMG 4000 - Design-Build Project Delivery

Professional practice, financial, legal, and ethical considerations in construction management are illustrated and discussed in the context of the design-build delivery system.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): CMG 3200(C)

CMG 4100 - Construction Equipment Management

Study of basic principles used in the construction industry for selecting and managing construction equipment. Focuses on understanding the time value of money, estimating equipment ownership and operating costs, selecting the proper equipment for specific tasks, and estimating equipment production.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): (CMG 3265 or CEE 3332) and EC 3400

CMG 4120 - Construction Planning and Scheduling

This course will introduce students to the basics of construction scheduling. Topics covered will include: Fundamentals of different scheduling methods such as Critical Path Method and linear scheduling. Resource allocation in schedules, and Schedule monitoring and control methods.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 3265 or CEE 3332

CMG 4200 - Construction Contracts

Legal aspects of construction to include a study of construction documents, the project manual, report requirements, agreements, change orders, and other administrative functions in building construction.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): BUS 2200 or CEE 3332

CMG 4210 - Construction Project Management

Provides students with an understanding of the principles required to deliver a construction project on time, within budget, and with acceptable quality. Topics include construction law, contracts, delivery systems, jobsite layout and control, submittals, record keeping, subcontracting and purchasing, quality management, change orders, claims, and dispute resolution.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CMG 4200 or CEE 3332

CMG 4300 - Construction Finance and Accounting

Focuses on the principles of accounting and financial management needed to make construction projects and companies financially successful. Includes profitability, projecting costs, cash flow and cash requirements, and equipment costs.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): ACC 2000 or EC 3400 or CEE 3332

CMG 4400 - Construction Safety Management

Provides an awareness and understanding of workplace safety practices. Emphasis on the construction industry, including the OSHA construction regulations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

CMG 4800 - Sustainable Construction

An introduction to the philosophy and practice of sustainable building construction with emphasis on underlying socio-environmental philosophies, sustainable directed building technologies and materials, and case studies of contemporary green buildings to culminate in a simple sustainable design project.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

CMG 4996 - Special Topics in Construction Management

Selected additional topics of interest in Construction Management based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Construction Management; Must be enrolled in one of the following Class(es): Senior

CMG 4997 - Independent Study in Construction Management

Independent study of an approved topic under the guidance of a Construction Management faculty member. May be either an academic, design or research problem/project.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Construction Management; Must be enrolled in one of the following Class(es): Senior

Computer Science

CS 1000 - Explorations in Computing

An introduction to the study of computing: fundamental concepts and skills; opportunities at Michigan Tech; career opportunities; social and ethical issues.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Software Engineering, Computer Science, Computer Systems Science, General Computing, Electrical Engineering; Must be enrolled in one of the following Class(es): Freshman

CS 1090 - Special Topics in Computer Science

Special topics in computer science offered on occasion based on student and faculty demand and interest.
Credits: variable to 3.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CS 1111 - Introduction to Programming in C/C++

Introductory course in C/++ programming. Topics include top-down analysis of problems, structured programming, control structures, functions, arrays, pointers, and file I/O. Basic concepts of object-oriented programming (classes, objects, function overloading) will also be introduced.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering, Robotics Engineering, Industrial Technology, Audio Production & Technology, Computer Network & System Admn, Electrical Eng Tech, Information Technology, Mechatronics; Must be enrolled in one of the following Class(es): Freshman, Sophomore

CS 1121 - Introduction to Programming I

Starting point of the computer science programs. A high-level, object-oriented programming language is introduced as a problem-solving tool. Topics include design, coding, documentation, debugging, and testing of programs. Programming assignments are given in both a closed lab setting and as homework.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1031(C) or MA 1032(C) or MA 1120(C)

CS 1122 - Introduction to Programming II

Continuation of CS 1121. Topics include data abstraction, class hierarchies and polymorphism, list, stack, queue and tree data structures, complexity-based algorithm and data structure choices, and recursion. Homework programming assignments are given.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CS 1121

CS 1131 - Accelerated Introduction to Programming

An alternative starting point of the computer science programs for students with some programming experience, combining material from CS1121 and CS1122, offered at an accelerated pace. Homework programming assignments are given.
Credits: 5.0
Lec-Rec-Lab: (0-4-2)
Semesters Offered: Fall
Restrictions: Permission of department required
Pre-Requisite(s): MA 1031(C) or MA 1032(C) or MA 1120(C) or MA 1160(C) or MA 1161(C) or MA 1121(C)

CS 1142 - Programming at the Hardware Software Interface

Programming in assembly language and C for students with prior experience in Java. Topics include binary number encodings, instruction set architecture, assembly language programming, and instruction encodings. C programming topics include program structure, preprocessor, arrays, structures, pointers, input/output, dynamic memory management, and linked data structures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CS 1122 or CS 1131

CS 2090 - Special Topics in Computer Science

Special topics in computer science offered on occasion based on student and faculty demand and interest.
Credits: variable to 3.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CS 2311 - Discrete Structures

Presents fundamental concepts in discrete structures that are used in computer science. Topics include sets, trees, graphs, functions, relations, recurrences, proof techniques, logic, combinatorics, and probability.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (CS 1121 or CS 1131) and (MA 1135 or MA 1160 or MA 1161 or MA 1121 or MA 2160)

CS 2321 - Data Structures

Presents fundamental concepts in data structures. Topics include abstract data types (priority queues, dictionaries and graphs) and their implementations, algorithm analysis, sorting, text processing, and object-oriented design. A significant programming project is assigned.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 1122 or CS 1131

CS 3000 - Ethical and Social Aspects of Computing

An examination of social and ethical issues associated with computing. Topics include: ethical theories and decision making, intellectual property, freedom of expression, privacy, security, and professional responsibility.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): CS 3141

CS 3090 - Special Topics in Computer Science

Special topics in computer science offered on occasion based on student and faculty demand and interest.
Credits: variable to 3.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CS 3141 - Team Software Project

This course focuses on software development as a team. It covers software design models emphasizing process activities including Agile methodologies and Secure Software Development Life Cycle practices. Key topics include version control, automated testing, and documentation. Students will develop skills in communication, teamwork.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (CS 2311 or MA 3210) and CS 2321

CS 3311 - Formal Models of Computation

Introduction to the theory of formal languages and computation. Topics include regular languages and finite automata, context-free languages and push-down automata, Turing-acceptable languages, Turing machines and the halting problem. Proof techniques and applications, such as parsing, are also treated.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 2311 or MA 3210

CS 3331 - Concurrent Computing

Concepts and techniques in concurrent computing. Topics include: processes and threads, mutual exclusion, semaphores, monitors and condition synchronization, deadlock, safety and liveness, message passing, and concurrent architectures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 2311 and CS 2321 and CS 3411

CS 3411 - Systems Programming

Development of robust programs that provide efficient services to system software developers. Topics include: file I/O, process creation and management, linking and libraries, interprocess communication, performance measurement, and socket programming.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 3421 or EE 3172

CS 3421 - Computer Organization

Introduction to the logical structure of computers, including the fundamentals of logic design, information storage and manipulation, control, and input/output. Topics include a review of current hardware technology, combinational and sequential logic, arithmetic, datapaths, hard-wired control, interrupts, caches, virtual memory, and an introduction to pipelining.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (CS 1141 and CS 1040) or CS 1142

CS 3425 - Introduction to Database Systems

This course provides an introduction to database systems including database design, query, and programming. Topics include goals of database management; data definition; data models; data normalization; data retrieval and manipulation with relational algebra and SQL; data security and integrity; database and Web programming; and languages for representing semi-structured data.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (CS 2311 or MA 3210) and CS 2321

CS 3712 - Software Quality Assurance

This course concentrates on ensuring quality through the software process including definition, analysis, and measurement of quality attributes. Topics are software testing, static analysis, code review, process improvement and security engineering emphasizing derivation of test cases from requirements specifications and writing test plans.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 3141

CS 3760 - Front End Development and Accessibility

Students will apply foundational skills to create navigable and accessible user interfaces. HTML and CSS will be explored. Students will learn about structure versus style, semantic markup, accessibility standards, assistive technologies, testing tools, approaches to front end development, design patterns, and adaptive layout techniques.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CS 2321

CS 4001 - National Cybersecurity Policy and Law

This course introduces the role of government in securing cyberspace. Students examine national cybersecurity policy and law. Topics include federal, state, and local entities involved in cybersecurity, relevant laws and regulations, concepts of civil liberties, intellectual property, privacy, development/diffusion of standards, and national security.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Senior

CS 4090 - Special Topics in Computer Science

Special topics in computer science offered on occasion based on student and faculty demand and interest.
Credits: variable to 4.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

CS 4099 - Directed Study in Computer Science

Students study one or more special topics in computer science under the direction of one or more faculty members.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

CS 4121 - Programming Languages

A discussion of the concepts underlying programming languages. Topics include programming paradigms; language theory and properties (including syntax, semantics, run-time behavior, and implementation issues); data, procedure, functional and control abstraction; functional programming, logic programming, and language security.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 2321 and CS 3311 and (CS 3421 or EE 3172)

CS 4130 - Compiler Design and Optimization

Design, theory, and programming language translators and the theory and implementation of optimizers. Topics include: intermediate representations, advanced code generation, control-and data-flow analysis, advanced compiler optimization, dynamic compilation, global register allocation and instruction scheduling.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): CS 4121

CS 4321 - Introduction to Algorithms

Fundamental topics in algorithm design, analysis, and implementation. Analysis fundamentals include asymptotic notation, analysis of control structures, solving recurrences, and amortized analysis. Design and implementation topics include sorting, searching, and graph algorithms. Design paradigms include greedy algorithms, divide-and-conquer algorithms, and dynamic programming.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (CS 2311 or MA 3210) and CS 2321

CS 4411 - Operating Systems

Principles of the design and implementation of operating systems. Topics include: process management, process scheduling, memory management, I/O, file systems. Includes a significant implementation component.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 3331 and CS 3421

CS 4425 - Database Management System Design

This course covers the design issues concerning the implementation of database management systems, including distributed databases. The topics include data storage, index implementation, query processing and optimization, security, concurrency control, transaction processing, and recovery.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): CS 3425

CS 4431 - Computer Architecture

Advanced course in architecture of high-performance computer systems. Topics include instruction-set design, simulation of processor architectures, multiple functional units, pipelining, dynamically scheduled pipelines, speculative execution, multi-core and multi-processor systems, advanced I/O subsystems and analytic models of architectural features of processors.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 3421

CS 4461 - Computer Networks

Computer network architectures and protocols; design and implementation of datalink, network, and transport layer functions. Introduction to the Internet protocol suite (TCP, UDP, IP), domain name service and protocols, file sharing protocols, wireless networks, and network security.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 3411

CS 4471 - Computer Security

This covers fundamentals of computer security. Topics include practical cryptography, access control, security design principles, physical protections, malicious logic, program security, intrusion detection, administration, legal and ethical issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): CS 3411 or CS 4411

CS 4611 - Computer Graphics

Introduction to interactive computer graphics. Topics include 3D viewing, 3D transformation, interactive techniques, animation, modeling, lighting, texturing, vertex programs, fragment programs, and graphics algorithms. Requires substantial programming homework.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (CS 1141 or CS 1142) and CS 2321 and MA 2330

CS 4710 - Model-Driven Software Development

This course focuses on modeling of software systems, automated analysis, verification, and design. Topics include declarative and imperative modeling languages, software tools for automated analysis and verification of models, specification languages for implementation, and formal specification languages for inductive verification of systems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): CS 3311 and CS 3141(C)

CS 4711 - Software Processes and Management

Focuses on the software development process and related management issues. Topics include software process models, the Capability Maturity Model, process tools, use of standards, software maintenance, configuration management, project planning and tracking, team management, and measurement and estimation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): CS 3141

CS 4723 - Network Security

Learn fundamental of cryptography and its application to network security. Understand network security threats, security services, and countermeasures. Acquire background knowledge on well known network security protocols. Address open research issues in network security.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): EE 4272 or CS 4461 or SAT 4812

CS 4740 - Development of Trusted Software

This course exposes students to the concepts of secure software development. Students will learn how to develop high-quality software that is resistant against cyber-attacks, by minimizing the number of vulnerabilities that can be exploited by an attacker. Topics include access control, race conditions, buffer overflows, and code injection.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 4471

CS 4741 - Senior Project in Trusted Software Development

A capstone course in development of trusted software. Students design, implement, or test software that is required to resist cybersecurity attacks.
Credits: 2.0; Repeatable to a Max of 4
Lec-Rec-Lab: (0-2-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Major(s): Cybersecurity; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): CS 3411 and CS 3712 and SAT 3812

CS 4750 - Teaching Methods in Computer Science

Provides teaching methods, models, and experiences for teaching computer science in secondary schools. Topics discussed include teaching methods, learning, security and maintenance of equipment, professional journals, ethics, legal issues, diversity, and problem solving. Requires admission to the Teacher Education Program.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ED 4700

CS 4760 - User Interface Design and Implementation

Principles of user interfaces (UI) design and implementation. Topics include: UI theory, design principles, evaluation, and tools. Requires completion of a group project implementing and evaluating a UI.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 3141

CS 4770 - Software Architecture

Software architecture and concerns; quality attributes, metrics, critical components of architectures, the use of packages, build tools and techniques, and cloud architectures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): CS 3425

CS 4791 - Senior Software Engineering Project I

A capstone project course. Using software engineering principles and techniques, students work as part of a team responsible for developing a quality software project.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): CS 3712 and CS 4760

CS 4792 - Senior Software Engineering Project II

A continuation of the capstone project experience, intended for Software Engineering majors.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall, Spring
Pre-Requisite(s): CS 4791

CS 4801 - Foundations of Machine Learning

The course covers classical statistical machine learning. Topics include classification (k-nearest neighbors, decision trees, random forests, logistic regression, naive bayes, neural networks), regression, clustering (partitional and hierarchical clustering), and evaluation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): DATA 2201 and (MA 2710 or MA 2720 or MA 3710 or MA 3720)

CS 4811 - Artificial Intelligence

Fundamental ideas and techniques that are used in the construction of problem solvers that use Artificial Intelligence technology. Topics include knowledge representation and reasoning, problem solving, heuristics, search heuristics, inference mechanisms, and machine learning.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CS 2311 and CS 2321 and (CS 3411 or CS 3421 or CS 3425 or CS 3331) and MA 3720

CS 4821 - Data Mining

Data mining focuses on extracting knowledge from large data sources. The course covers data mining concepts, methodology (measurement, evaluation, visualization), algorithms (classification/regression, clustering, association rules) and applications (web mining, recommender systems, bioinformatics).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): (CS 3425 or MIS 3100 or SAT 3210) and (MA 2330 or MA 2320 or MA 2321) and (MA 2710 or MA 2720 or MA 3710)

Data Science

DATA 1000 - Explorations in Data Science

This course introduces data science concepts using real-world examples and applications. Topics include the data science lifecycle, forming data science questions, data privacy, ethics, and more.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Data Science; Must be enrolled in one of the following Class(es): Freshman

DATA 1100 - Practical Data Science Tools

Introduces students to working in Linux environments and at the command line. Topics include shell commands, piping, shell scripting, working with git, markdown, familiarity with code editors. Additional topics may include LaTeX and data cleaning tools.
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Software Engineering, Computer Science, Environmental Data Science, Data Science

DATA 1200 - Data Science with Python

The course introduces data science topics including inferential and computational thinking using Python. Topics include table operations, functions, control structures, visualization, sampling, and inference
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): MA 1030(C) or MA 1031(C) or MA 1032(C) or MA 1160(C) or MA 1161(C)

DATA 2201 - Foundations of Data Science

Introduces data science technologies and methods that provide a foundation for subsequent Data Science classes. Topics covered include working with data and applied linear algebra in standard numerical computing libraries.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): (DATA 1202 or DATA 1200) and ((CS 1122 or CS 1131) or (CS 2311 and CS 2321)) and (MA 2320(C) or MA 2330(C) or MA 2321(C))

DATA 4991 - Data Science Project

A capstone project course. Students will use data science methods and tools to analyze and report out on real-world projects.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Major(s): Data Science; Must be enrolled in one of the following Class(es): Senior

Economics

EC 2001 - Principles of Economics

An introduction to economics. The microeconomics portion covers consumer choice, the firm, value and price theory, and distribution theory. The macroeconomics portion covers national income analysis, fiscal policy, money and monetary policy, the commercial banking system, and the Federal Reserve System.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1020 or MA 1030 or MA 1031 or MA 1032 or MA 1120 or MA 1135(C) or MA 1160(C) or MA 1161(C) or MA 1121(C) or ALEKS Math Placement >= 61 or CEEB Calculus AB >= 2 or CEEB Calculus BC >= 2 or ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540

EC 3002 - Microeconomic Theory

The study of consumer and producer choices, market demand and supply, and market structures.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EC 2001 and (MA 1135 or MA 1160 or MA 1161 or MA 1121)

EC 3003 - Macroeconomic Theory

Analysis of the determinants of the level of output, employment, prices, and economic growth with an emphasis on fiscal policy and monetary policy.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EC 2001 and (MA 1135 or MA 1160 or MA 1121 or MA 1161)

EC 3100 - International Economics

Introduction to international economics, including balance of payments, accounting, foreign exchange markets, international trade theory, barriers to trade, trade and development, regional economic integration, and current U.S. international economic issues.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EC 2001

EC 3300 - Industrial Organization

Economic analysis of market power and industry structure. Topics include the goals of public policy toward business, antitrust policy, economic regulation, public enterprise, and social regulation of health, safety, and the environment.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EC 2001

EC 3400 - Economic Decision Analysis

Studies economic decision-making for actions occurring over time. Covers decision tools for comparing alternatives, public project evaluation, risk and uncertainty, mutually exclusive decisions, multiple objective decisions, interest rate calculations, cash flow analysis, depreciation and taxes, cost of capital, capital budgeting.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Engineering Management, Marketing, Management, Management Information Systems, Accounting, Finance; May not be enrolled in one of the following Class(es): Freshman, Sophomore

EC 4000 - Senior Seminar in Economics

A senior capstone seminar in which students discuss and conduct research under the guidance of several faculty members.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Major(s): Economics, Economics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

EC 4050 - Game Theory/Strategic Behavior

The study of strategic situations involving the interactions of individuals. Modeling techniques are applied to game situations faced in business, entertainment, politics, and the daily routine of life.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

EC 4100 - Mathematical Economics

Application of the principal mathematical techniques used in economic theory and modeling. Topics include optimization, marginal analysis, comparative statics, and other applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): EC 2001 and (MA 1160 or MA 1161 or MA 1121 or MA 1135)

EC 4200 - Econometrics

Introduces techniques and procedures to estimate and test economic and financial relationships developed in business, economics, social and physical sciences.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (EC 2001 or EC 3002 or EC 3003) and (BUS 2100 or MA 2710 or MA 2720 or MA 3710) and (MA 1135 or MA 1160 or MA 1161 or MA 1121)

EC 4400 - Banking and Financial Institutions

Analysis of asset and liability management of financial institutions and the role of financial institutions in the U.S. and international economy.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (EC 3003 or FIN 3000)

EC 4500 - Public Sector Economics

Economic analysis of how democratic governments generate revenue (primarily taxation) and make expenditure decisions and how such decisions impact the welfare of individuals. Topics include market failures, voting processes, income redistribution programs, efficiency and incidence of taxation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): EC 2001

EC 4620 - Energy Economics

Introduction to the institutional, technical, and economic issues of the production and use of energy resources, including petroleum, natural gas, coal, nuclear, electric utilities, and alternative energy. Coursework applies economic analysis to supply, distribution, and use of energy resources, including environmental and social consequences.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): EC 2001

EC 4630 - Mineral Industry Economics

Studies the role of minerals and metals in society and the economics of their use. Applies economic principles to examine the supply, demand, markets, and foreign trade for important minerals and metals. Examines the effect of government policies on the minerals industries. Requires a technical report.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): EC 2001

EC 4640 - Natural Resource Economics

Studies the economics of nonrenewable resources (energy and minerals) and renewable resources (water, fisheries, forests and species). Discusses the economics of land use change, macroeconomic topics such as economic growth, sustainability and green accounting.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EC 2001 or EC 3002 or FW 4080

EC 4650 - Market Failure and the Environment

Considers the efficient and equitable use of environmental resources, including air, water, land, wilderness and parks, wildlife and other ecological systems. Measures the benefits and costs of decreasing pollution, cleaner environment, and protecting scarce ecological resources. Addresses market failures and the economic valuation of environmental amenities.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): EC 2001 or EC 3002

EC 4710 - Labor/Human Resource Economics

Economic analysis of labor markets and human resources. Topics include the supply and demand for labor, wage determination, human capital theory, returns to education and training, causes of wage differentials, and economic effects of discrimination.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): EC 2001

EC 4900 - Research

Under the general guidance of a faculty member, students read, conduct research, and prepare reports and papers as required.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Pre-Requisite(s): EC 2001

EC 4990 - Special Topics in Economics

Economic topics of interest to students and faculty.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Pre-Requisite(s): EC 2001

Electrical & Computer Engineering

EE 1001 - Introduction to Electrical, Computer, and Robotics Engineering

Exploration of the fields of electrical, computer, and robotics engineering, including career options, degree programs, and modern industrial trends.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

EE 2112 - Electric Circuits and Lab

This course will cover basic electrical concepts, resistive circuits, nodal and loop analysis, superposition, Thevenin and Norton equivalents, maximum power transfer, capacitors, inductors, AC analysis, and 1st and 2nd order transient analysis.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 3520(C) or MA 3521(C) or MA 3530(C) or MA 3560(C)

EE 2174 - Digital Logic and Lab

Introduces analysis, design, and application of digital logic. Includes Boolean algebra, binary numbers, logic gates, combinational and sequential logic, storage elements and hardware-description-language based synthesis.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CS 1121 or CS 1131 or CS 1111

EE 2180 - Introduction to Robotics and Lab

Introduces the following topics: robotic actuators, inverse and forward kinematics, control methods, applied statistics, environment mapping, and path finding. Topics will be further explored during hands on and practical lab experiments.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): (EE 3010(C) or EE 2112(C)) and (MA 2320(C) or MA 2321(C) or MA 2330(C))

EE 2190 - Introduction to Photonics

Topics include basic geometrical and wave optics, fiber optics, lasers, detectors, and optical communication systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3521 and PH 2200(C)

EE 2230 - Printed Circuit Seminar Series

Seminars and lectures relating to the design, layout, fabrication, and assembly of printed circuits will be presented by instructor as well as industry experts.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Permission of instructor required
Co-Requisite(s): EE 2231
Pre-Requisite(s): CH 1150 and CH 1151

EE 2231 - Printed Circuit Fabrication

Printed circuit board fabrication techniques are presented and explored utilizing wet-chemical process techniques. Single and multi-layer boards using internal layers for power and ground planes as well as plated feed-through via structures, solder masks and silk screens will be discussed. While hands on fabrication will be the main focus, students will be introduced to software design packages specific to circuit layout and design. Final testing and evaluation of the fabricated boards will be performed.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: Permission of instructor required
Co-Requisite(s): EE 2230

EE 3010 - Circuits and Instrumentation for Cyber Physical Systems

Designed for nonmajors. Covers the principles of electrical and electronic measurements, including dc, ac, semiconductor devices, amplifiers, and filtering.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Electrical Engineering, Computer Engineering
Pre-Requisite(s): MA 1121 or MA 1160 or MA 1161

EE 3120 - Electric Energy Systems

An overview of the generation and utilization of electrical energy. Covers three-phase circuits, transformers, photovoltaics, batteries, electromechanical energy conversion, and an overview of electric power systems, including economic issues.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EE 2010 or EE 3010 or EE 2112(C) or EE 2111

EE 3131 - Electronics

Covers the fundamentals of electronic devices and circuits; operational amplifiers, bipolar junction transistors, diodes, and MOSFETs.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EE 2112 or EE 3010

EE 3140 - Electromagnetics

Covers basic principles of engineering electromagnetics with an emphasis on Maxwell's equations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): PH 2200 and MA 3160 and (EE 2110 or EE 2112)

EE 3160 - Signals and Systems

Introduces the mathematical analysis of signals, systems, and control. Topics include differential equations, Fourier series, Fourier transforms, LaPlace transforms, frequency response, Bode plots, state models, and an introduction to control systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): (EE 3010 or EE 2112) and (MA 2320 or MA 2321 or MA 2330) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

EE 3172 - Fundamentals of Computer Organization

Introduction to the fundamental structure and organization of computing systems. Topics include control logic, datapaths, instruction processing, caches, and pipelines. Includes a significant processor implementation project.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EE 2174 and CS 1142

EE 3174 - Introduction to Microcontrollers and Embedded Systems

Introduces the concepts of microcontroller-based systems. Describes basic characteristics of microcontrollers and how to program them in C and assembly language. Also discusses I/O devices, synchronization, and bus protocols.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EE 2174 and (CS 1111 or CS 1142 or CS 1121 or CS 1131)

EE 3180 - Introduction to Probability and Random Signal Analysis

Probability density and distribution functions, expected value, correlation, and random vectors. Wide sense stationary random signals. The correlation function and spectral density. Random signals and noise in linear systems. An introduction to hypothesis testing and parameter estimation. Engineering applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EE 3160

EE 3190 - Optical Sensing and Imaging

Optical sensing techniques, including imaging and non-imaging systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MA 3520 or MA 3521 or MA 3530 or MA 3560

EE 3261 - Control Systems

Mathematical formulation of control problems (both transfer function and state-variable descriptions); analysis of feedback control systems (stability, transient performance, steady-state error, sensitivity, etc.); analog and digital simulation; and experiments with physical systems.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EE 3160

EE 3280 - Robot Operating Systems

An introduction to the robotics middleware enabling robot platforms used in autonomous vehicles and advanced manufacturing. Students will learn the basics of distributed robotics software architecture, hardware considerations and associated simulation tools.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): EE 2180 and SAT 2711

EE 3290 - Photonic Material, Devices, and Applications

Light wave propagation in optical crystals and fibers, detection, and the creation of light in semiconductors.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Engineering, Physics, Applied Physics, Physics (BA), Biomedical Engineering, Materials Science and Engrg; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): EE 3140 or PH 2400 or EE 2190

EE 3373 - Introduction to Programmable Controllers

The design of discreet sequential controls using programmable logic controllers (PLCs). Relay logic is used to introduce ladder logic and ladder logic is used to program the PLC. Introduces a structured approach to sequential control design. Data acquisition is introduced using BridgeVIEW software
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Robotics Engineering
Pre-Requisite(s): EE 2112 or EE 3010

EE 3901 - Design Fundamentals

The design process; includes team design activities and studies project management, ethics, and professionalism.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): EE 2112 or (EE 2180 and EE 3010) and UN 1015

EE 4000 - Undergraduate Research

An undergraduate research experience during the senior year in electrical or computer engineering. Students work on an active research project/grant with a faculty member. A report will be published in the department and archived.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Junior, Senior

EE 4173 - Computer System Engineering and Performance

Covers the principles and practices of modern computer architecture. Emphasizes quantitative performance evaluation of: memory hierarchies, from cache through virtual memory; pipelined processors with advanced hazard management; and combined processor/memory systems. Introduces RAID, superscalars, parallel processing, cache coherence, performance simulation software.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering
Pre-Requisite(s): EE 3173 or EE 3174

EE 4219 - Introduction to Electric Machinery and Drives

Provides a thorough understanding of how electric machines can be used to drive loads with control of speed, torque and position. Topics include basic electro-mechanics, rotating machinery, dc machines, ac machines, power electronics and load modeling. Applications include industrial systems, hybrid/electric vehicles and electric power systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (EE 2112 or EE 3010) and EE 3120

EE 4220 - Introduction to Electric Machinery and Drives Laboratory

Provides a hands on understanding of how electric machines can be used to drive loads with control of speed, torque, and position. Topics include basic electro-mechanics, rotating machineer, dc machines, ac machines, power electronics, and load modeling.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Pre-Requisite(s): EE 4219(C)

EE 4221 - Power System Analysis 1

Covers power transmission line parameters and applications, symmetrical components, transformer and load representations, systems faults and protection, and the per unit system.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3120 and (EE 2112 or EE 3010)

EE 4222 - Power System Analysis 2

Topics covered include symmetrical components; symmetrical faults; unbalanced faults; generating the bus impedance matrix and using it in fault studies; power system protection; power system operation; power system stability.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 4221

EE 4226 - Power Engineering Laboratory

A laboratory based course highlighting single phase and three phase power concepts, including: power factor, single and three phase transformer configurations, non-ideal transformers, synchronous machines, renewable energy, power flow and fault simulations, relay settings and relay testing and calibration.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring, Summer
Restrictions: Permission of instructor required
Pre-Requisite(s): EE 4221 and EE 4222(C)

EE 4227 - Power Electronics

Fundamentals of circuits for electrical energy processing. Covers switching converter principles for dc-dc, ac-dc, and dc-ac power conversion. Other topics include harmonics, pulse-width modulation, feedback control, magnetic components and power semiconductors.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): EE 3120 and (EE 3130(C) or EE 3131)

EE 4228 - Power Electronics Lab

Fundamentals of design, construction and control of circuits for electrical energy processing. Covers switching converter principles for dc-dc, ac-dc, and dc-ac power conversion. Other topics include harmonics, pulse-width modulation, feedback control, magnetic components and power semiconductors.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): EE 4227(C)

EE 4231 - Physical Electronics

Device physics and physical models of the most basic solid-state device structures. Major topics include the terminal characteristics and their physical origin, device design, and device applications.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EE 3130 or EE 3131

EE 4232 - Electronic Applications

Study of electronic circuits under small- and large-signal conditions. Typical topics include analysis and design of power and RF amplifiers, feedback circuits, oscillators, timing circuits, and wave-shaping circuits.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): EE 3130 or EE 3131

EE 4235 - Sensing and Processing in Robotic Applications

Sensing and signal processing for robotics applications in manufacturing and autonomous navigation. Heavy emphasis on developing, testing, and evaluating algorithms. MATLAB programming required.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): EE 2180 and (ENG 1101 or ENG 1101T)

EE 4240 - Introduction to MEMS

Fundamentals of micromachining and microfabrication techniques, including planar thin-film process technologies, photolithographic techniques, deposition and etching techniques, and the other technologies that are central to MEMS fabrication.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

EE 4250 - Modern Communication Systems

Introduces the mathematical theory of communication science. Topics include baseband and digital signaling, bandpass signaling, AM and FM systems, bandpass digital systems, and case studies of communication systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): EE 3160 and EE 3131 and EE 3180

EE 4252 - Digital Signal Processing and its Applications

Digital signal processing techniques with emphasis on applications. Includes sampling, the Z-transform, digital filters and discrete Fourier transforms. Emphasizes techniques for design and analysis of digital filters. Special topics may include the FFT, windowing techniques, quantization effects, physical limitations, image processing basics, image enhancement, image restoration and image coding.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall
Pre-Requisite(s): EE 3160

EE 4253 - Real Time Signal Processing

Practical implementation of digital signal processing concepts as developed in EE4252. Emphasis on applications of DSP to communications, filter design, speech processing, and radar. Laboratory provides practical experience in the design and implementation of DSP solutions.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): EE 4252

EE 4262 - Digital and Non-linear Control

Introduction to state space analysis and design (state feedback, observers, and observer feedback); digital control system design and analysis (Z-transforms, difference equations, the discrete-time state model, and digital implementation of controllers); introduction to nonlinear systems (equilibrium states, linearization, phase plane analysis, and describing function analysis); and experiments with physical systems.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): EE 3261

EE 4271 - VLSI Design

Design of VLSI circuits using CAD tools. Analysis of physical factors affecting performance.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall
Pre-Requisite(s): EE 3131 and EE 2174

EE 4272 - Computer Networks

Computer network architectures and protocols; design and implementation of datalink, network, and transport layer functions. Introduction to the Internet protocol suite (TCP, UDP, IP), domain name service and protocols, file sharing protocols, wireless networks, and network security.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CS 3411

EE 4295 - Introduction to Propulsion Systems for Hybrid Electric Vehicles

Hybrid electric drive vehicle analysis will be developed and applied to examine the operation, integration, and design of powertrain components. Model based simulation and design is applied to determine vehicle performance measures in comparison to vehicle technical specifications. Power flows, losses, energy usage, and drive quality are examined over drive-cycles via application of these tools.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of Engineering, College of Computing; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MEEM 2700 or ME 2700 or EE 2112 or Graduate Status >= 1

EE 4296 - Experimental Studies in Vehicle Electrification

Hands-on course on vehicle electrification. Covers propulsion architecture, vehicle and component testing, fuel consumption, aerodynamics, rolling resistance, engines, batteries, electric machines, and power electronics. Emphasis on system interactions, powertrain modes, and regenerative braking for efficiency.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

EE 4370 - Internet of Things Applications and Design

This course consists of the application areas, revolution, and fundamental building blocks (data collection, connectivity, and analysis) in Internet of Things. A hands-on, multi-discipline project-oriented course.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: Must be enrolled in one of the following College(s): College of Engineering, College of Computing; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): EE 4272

EE 4375 - Autonomous Vehicle Design

Design of autonomous systems focusing on safety. Covers localization, sensor fusion, and motion planning. Emphasizes autonomy capability level, functional safety, and hazard analysis. Students will use autonomous vehicle data sets to develop sensing, perception, and path-planning strategies on simulated autonomous vehicles.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Spring
Pre-Requisite(s): (EE 3261 or MEEM 3750) and EE 3280

EE 4411 - Engineering Electromagnetics

A mathematically rigorous study of dynamic electromagnetic fields, beginning with Maxwell's equations. Topics include scalar and vector potentials, waves, and radiation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): EE 3140

EE 4490 - Laser Systems and Applications

Survey of laser types and analysis of common physical and engineering principles, including energy states, inversion, gain, and broadening mechanism from a quantum mechanical perspective. Laser applications and laser properties are explored in the laboratory portion.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall
Pre-Requisite(s): EE 3140

EE 4723 - Network Security

Learn fundamental of cryptography and its application to network security. Understand network security threats, security services, and countermeasures. Acquire background knowledge on well known network security protocols. Address open research issues in network security.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): EE 4272 or CS 4461 or SAT 4812

EE 4737 - Embedded System Interfacing

Covers the use of low-power microcontrollers and hardware-dependent C for embedded sensing and control systems. Emphasizes direct interfacing with analog and digital sensors and actuators of several different modalities, to implement end-to-end embedded systems for applications including robotics and wireless sensor nets.
Credits: 4.0
Lec-Rec-Lab: (3-0-1)
Semesters Offered: Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): (CS 1111 or CS 1142) and (EE 3171 or EE 3173)

EE 4777 - Distributed Additive Manufacturing Using Open-Source 3-D Printing

This course provides an overview of open-source hardware in theory and practice for an introduction to distributed additive manufacturing using open-source 3-D printing. Each student will build a customized RepRap and will learn all hardware and software for maintaining it.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Junior, Senior

EE 4800 - Special Topics in Electrical and Computer Engineering

Covers specific topics in electrical engineering.
Credits: variable to 4.0; Repeatable to a Max of 8
Semesters Offered: On Demand
Restrictions: Permission of instructor and department required

EE 4805 - Electrical Engineering Project

A project in electrical engineering. An individual student or a group of students complete a mutually- agreed-upon project in consultation with a faculty member.
Credits: variable to 3.0; Repeatable to a Max of 6; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor and department required

EE 4901 - EE Design Project 1

The first semester of a program of study in which a group of students work on an engineering design project in consultation with a faculty member. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): (EE 3131 or (EE 3280 and EE 3261(C))) and (EE 3901 and (EE 3171(C) or EE 3173(C) or EE 3174))

EE 4910 - EE Design Project 2

The second semester of a program of study in which a group of students work on an engineering design project in consultation with a faculty member. (Senior project ready as defined by major substitutes for prerequisites)
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring
Pre-Requisite(s): EE 4901

Electrical Engineering Technology

EET 1121 - Circuits I

Fundamental theory of lumped-element DC and AC electrical circuits. Voltage, current, resistance, energy, and power. DC network analysis and network theorems. Inductance and capacitance. First-order transient analysis for RL and RC circuits. Sinusoidal steady-state analysis of simple AC circuits.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Co-Requisite(s): EET 1122
Pre-Requisite(s): MA 1031 or MA 1032 or MA 1120 or MA 1121(C) or MA 1160(C) or MA 1161(C) or MA 1135(C)

EET 1122 - Circuits I Lab

Laboratory exercises designed to complement the theory in a first course in lumped-element DC and AC electrical circuits. Electrical laboratory safety. Breadboard construction of electrical circuits. Electronic instrumentation, measurement techniques, and data analysis.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Co-Requisite(s): EET 1121
Pre-Requisite(s): MA 1031 or MA 1032 or MA 1120 or MA 1121(C) or MA 1160(C) or MA 1161(C) or MA 1135(C)

EET 1411 - Basic Electronics

Introduction to basic electrical principles and devices including DC and AC circuits, diodes, transistors, operational amplifier ICs, power supply regulation, and elements of communication systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Information Technology, Surveying Engineering, Computer Network & System Admn, Mechanical Engineering Tech, Cybersecurity, Theatre & Entertain Tech (BS)
Pre-Requisite(s): MA 1031 or MA 1032 or MA 1120 or MA 1160(C) or MA 1161(C) or MA 1135(C) or MA 1121(C)

EET 2121 - Circuits II

Advanced treatment of passive linear electrical circuits. Superposition, Thevenin, Norton, and maximum power transfer theorems. Analysis of AC networks with attention to frequency response, attenuation, resonance, bandwidth, and terminal impedance. Bridge circuits and filters.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Co-Requisite(s): EET 2122
Pre-Requisite(s): (EET 1121 and EET 1122) and (MA 1160 or MA 1161)

EET 2122 - Circuits II Lab

Laboratory exercises designed to complement the theory in an advanced course on passive linear DC and AC electrical circuits. Electrical laboratory safety. Measurement of frequency response, attenuation, resonance, bandwidth, and terminal impedance. Measurement accuracy considerations. Circuit simulation tools.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Co-Requisite(s): EET 2121
Pre-Requisite(s): (EET 1121 and EET 1122) and (MA 1160 or MA 1161)

EET 2142 - Digital Design and Modeling

Emphasizes the language concepts of digital systems design using VHDL with emphasis on good design practices and writing verification testbenches. Students will gain valuable hands-on experience writing efficient hardware design code and performing simulations using ModelSim.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): EET 2411

EET 2150 - Applied Mathematics for Engineering Technology

Mathematical theory, mathematical modeling, numerical methods, and algorithms with applications drawn from engineering technology, including electrical, mechanical, mechatronic, and manufacturing engineering technology. Topics covered include complex arithmetic, phasors and complex exponentials, linear algebra, Fourier and Laplace transforms. MATLAB programming is introduced to solve problems encountered in engineering technology with emphasis on modeling of electrical and mechanical systems.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MA 2160(C) and EET 1121

EET 2233 - Electrical Machinery

Fundamental steady-state analysis of DC, AC polyphase and AC single-phase electrical machines as well as transformers.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): (EET 1121 and EET 1122) or EET 1411

EET 2411 - Digital Electronics

Introduction to the fundamentals of the digital electronics that make up microprocessors. Topics include number systems and codes, Boolean algebra, combinational and sequential logic circuits, arithmetic circuits, and digital memory.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Information Technology, Mechatronics, Electrical Eng Tech, Theatre & Entertain Tech (BS), Sound Design, Computer Network & System Admn, Cybersecurity, Audio Production & Technology
Pre-Requisite(s): EET 1411 and (MA 1031(C) or MA 1032(C) or MA 1120(C) or MA 1160(C) or MA 1161(C) or MA 1135(C) or MA 1121(C))

EET 3131 - Sensors and Instrumentation

Sensors and instrumentation used in a wide variety of industrial applications. Instrument static characteristics, measurement errors, and calibration. Signal conditioning circuits including instrumentation amplifiers, DC bridges, and filters. Sensors for measuring motion, force, pressure, flow, and temperature, including physical principles and required electronic circuits.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): EET 1411 or EET 2121 or PH 2230 or EE 2111 or EE 3010

EET 3144 - Introduction to Industrial Robotics

This course introduces concepts of industrial robotics. Topics on mechanics, electronics, controls, forward and inverse kinematics, classification of end-effectors, programming, and the application of industrial robots are covered. FANUC Roboguide and Mitsubishi RT Toolbox simulation software packages are used to program and simulate industrial production scenarios.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer

EET 3225 - Analog Electronic Circuits

Analog electronic devices and circuits, including diodes, bipolar junction transistors, and operational amplifiers. Practical applications include amplifiers, rectifiers, and comparators.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): EET 2121

EET 3281 - Electrical Project Development and Troubleshooting

Covers soldering, component layout, printed circuit board artwork, troubleshooting, electrical and environmental factors in design as well as an overview of the practical methods used by industry to process projects. The student designs and fabricates a circuit board and assembles a project.
Credits: 3.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Spring
Pre-Requisite(s): EET 2121 and EET 3225

EET 3373 - Introduction to Programmable Controllers

The design of discreet sequential controls using programmable logic controllers (PLCs). Relay logic is used to introduce ladder logic and ladder logic is used to program the PLC. Introduces a structured approach to sequential control design. Data acquisition is introduced using BridgeVIEW software.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Information Technology, Electrical Eng Tech, Mechatronics, Computer Network & System Admn, Data Acquisition & Indust Cont, System and Network Security, Mechatronics
Pre-Requisite(s): EET 1411 or EET 2121 or PH 2230 or EE 2112 or EE 3010 or EET 2411 or EE 2174

EET 4144 - Real-Time Robotics Systems

Covers the components of a robot system, safety, concepts of a work-cell system, geometry, path control, automation sensors, programming techniques, hardware, and software. Students taking this course have an opportunity to earn FANUC Industrial Certificate "FANUC CERT HandlingTool Operations and Programming", Students must pass safety assessment above 80% and fulfill additional course requirements to be eligible.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): EET 1411 or EET 2121 or PH 2230 or EE 2111 or EE 3010

EET 4147 - Industrial Robotic Vision Systems and Advanced Teach Pendant Programming

Procedures for setting up, teaching, testing, and modifying robot vision systems widely used in industrial automation. Introduces advanced Teach Pendant Programming to develop complex scenarios for integrating robots into industrial cells. Final project must demonstrate proficiency in setting up and programming an advanced robotic vision scenario. Students taking this course have an opportunity to earn FANUC Industrial Certificate "FANUC CERT 2D iR-Vision". Students must pass safety assessment above 80% and fulfill additional course requirements to be eligible.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Spring, Summer
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): EET 4144

EET 4233 - Power Electronics and Drive

An introduction to power electronics and electrical power converters, covering topics such as speed control for motors using variable voltage drives and variable frequency drives as well as speed profiling. Includes hands-on lab exercises that offer practical experience with drive systems complemented by MATLAB simulations for in-depth analysis.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): EET 2233 and EET 3225

EET 4253 - Data Acquisition and Signal Processing

Data acquisition hardware and interfaces with different industrial sensors. Software development for data acquisition, signal processing, and real-time actuator control. Hands-on experience through laboratory experiments using commercial hardware and software platforms. Fundamentals of data acquisition systems (DASs), analog-to-digital convertors (ADCs), signal conditioning circuit design, actuators and drivers, and DAS design and integration.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Pre-Requisite(s): EET 3131

EET 4311 - Control Systems

Topics include: Fourier and Laplace transforms, signal comparison techniques and transfer functions. Control techniques addressed will include feedback, stability, Bode and Nyquist diagrams, and PID controllers.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MET 3130 or (MET 2110 and MET 2130) and EET 2150

EET 4373 - Advanced Programmable Controllers

Using Allen Bradley Contr Logix and SLC500 programmable controllers, course covers structured programming, Sequential Function Charts, networking, proportional integral differential control, data acquisition and interfacing. The labs will require students to write and troubleshoot complex PLC programs.
Credits: 4.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical & Computer Engineer, Electrical Eng Tech, Robotics Engineering, Mechatronics, Computer Engineering, Electrical Engineering; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): EET 3373 or EE 3373

EET 4460 - Senior Project I

Capstone course phase I, requiring the application of knowledge gained in lower division courses. Projects are normally team oriented, require weekly progress reports, and culminate with a final report and oral presentation.
Credits: 3.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): EET 3131

EET 4480 - Senior Project II

A capstone course requiring the application of knowledge gained in lower division courses. Projects are normally team oriented, require weekly progress reports, and culminate with a final report and oral presentation.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): EET 4460

EET 4501 - Applied Machine Learning

Introduces the general concepts and algorithms of machine learning (ML) with their implementation and applications to practical problems of modeling, detection, estimation, prediction, and control. Applications include cybersecurity, healthcare, robot vision, remote sensing, automation, and natural language processing.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SAT 4310 or SAT 4650 or CS 1121

EET 4707 - Autonomous Systems

The main concepts of autonomous systems will be introduced including motion control, navigation, and intelligent path planning and perception. This is a hands-on project based course. Students will have the opportunity to work with mobile robotics platforms. Having a foundational understanding of programming is recommended to make the most of this course.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechatronics, Electrical Eng Tech, Mechatronics
Pre-Requisite(s): (EET 4311 or EET 5311 or MET 4801 or MET 5801) and (CS 1111 or CS 1121 or CS 1131 or SAT 4310 or SAT 4650)

EET 4996 - Special Topics in Electrical Engineering Technology

Selected additional topics of interest in Electrical Engineering Technology based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Mechatronics, Electrical Eng Tech, Mechatronics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

EET 4997 - Independent Study in Electrical Engineering Technology

Independent study of an approved topic under the guidance of an Electrical Engineering Technology faculty member. May be either an academic, design, or research problem/project.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Electrical Eng Tech, Mechatronics; Must be enrolled in one of the following Class(es): Senior

EET 4998 - Undergraduate Research in Electrical Engineering Technology

An undergraduate research experience in Electrical Engineering Technology. Under the guidance of an Electrical Engineering Technology faculty member, students work on a selected/approved research problem or work directly with faculty on active research projects/grants. May require more than one semester to complete.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Electrical Eng Tech, Mechatronics; Must be enrolled in one of the following Class(es): Senior

EET 4999 - Professional Practice in Electrical Engineering Technology

Addresses engineering professional ethics, legal issues, professional development, and corporate culture as they relate to engineering technology graduates and our global society.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Electrical Eng Tech, Mechatronics; Must be enrolled in one of the following Class(es): Senior

Engineering Fundamentals

ENG 1002 - Introduction to 3-D Spatial Visualization

Intended for first-year engineering students with a demonstrated need for the development of 3-D spatial visualization skills. Topics include isometric sketching, orthographic projection, object transformations, 3-D coordinate systems, patterns folding to 3-D objects, and cross sections of solids.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

ENG 1101 - Engineering Analysis and Problem Solving

An introduction to the engineering profession and to its various disciplines. Focuses on developing problem-solving skills, computational skills, and communication skills. Through active, collaborative work, students work on teams to apply the engineering problem-solving method to "real-world" problems.
Credits: 3.0
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): (MA 1031(C) or MA 1032(C) or MA 1120(C) or MA 1160(C) or MA 1161(C) or MA 1121(C) or MA 2160(C) or MA 3160(C))

ENG 1101T - Transfer Non-Seminar

Credits: 3.0
Semesters Offered: On Demand

ENG 1102 - Engineering Modeling and Design

Continuation of ENG1101. Introduction to the engineering design process with an emphasis on graphics and documentation. Focuses on engineering problem solving in the context of the design process.
Credits: 3.0
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): (MA 1031 or MA 1032 or MA 1120 or MA 1160(C) or MA 1161(C) or MA 1121(C) or MA 2160(C) or MA 3160(C)) and (ENG 1101 or ENG 1101T or (ENG 1001 and ENG 1100))

ENG 1505 - Introduction to Systems Engineering

Introduces students to the discipline of systems engineering in a variety of industries. Uses systems thinking methods and tools to represent systems with an emphasis on engineering relevance.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

ENG 1885 - Discover Engineering Careers

Investigate a variety of engineering majors and career options. Presentations by various professionals will provide background on their undergraduate degree experience and perspective on working as an engineer.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

ENG 1990 - Special Topics in Engineering

Engineering topics of interest to students and faculty that are not normally covered in the existing courses.
Credits: variable to 5.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required

ENG 2060 - Facilitating Group Learning

Development of facilitation skills in group environments. Topics include peer-learning strategies, developing inclusive classrooms, and facilitation techniques.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): UN 1015

ENG 2120 - Statics-Strength of Materials

The composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, and 2nd moments of area. Intro to the mechanical behavior of materials, including calculation of stresses, strains, and deformations due to axial, torsional, and flexural loading. Uses MATLAB.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Mechanical Engineering, Civil Engineering
Pre-Requisite(s): MA 2160 and PH 2100 and (ENG 1101 or ENG 1101T or CS 1111 or CS 1121 or CS 1131)

ENG 2505 - Introduction to Low Fidelity Systems Modeling

Students utilize a software tool to model a range of natural and human-made systems to gain understanding and ability to apply a systems modeling approach for analysis of systems of increasing complexity.
Credits: 3.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): ENG 1505 and (MA 1030 or MA 1031 or MA 1032 or MA 1160 or MA 1161 or MA 1135 or MA 2160(C)) and (ENG 1001 or ENG 1101 or CS 1121 or CS 1131 or MIS 2100 or ENG 1101T)

ENG 2990 - Special Topics in Engineering

Engineering topics of interest to students and faculty that are not normally covered in the existing courses.
Credits: variable to 5.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required

ENG 3060 - Developing Mentoring Skills

Provides an overview of mentoring from the mentee and mentor perspective in an active learning environment. Topics include various mentoring techniques, providing effective feedback, and observational strategies.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ENG 3505 - Practicum in Systems Thinking and Systems Modeling

Students will select a physical or human-made system and develop intermediate level systems models. Models will be developed using the tools mastered in previous classes and other necessary components of the STELLA environment. Communication of the modeling activity will be an important aspect of the class.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): ENG 1505 and ENG 2505

ENG 3525 - Design for Sustainability

Engage with diverse sustainable design challenges faced in the engineering industry. Focus on design processes applied to real-world problems, with emphasis on environmental, ethical, economic, and technical resource constraints in a circular economy through case studies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): ENG 2120 or MEEM 2110 or MET 2110 or BE 3300

ENG 3830 - Engineering Professional Practice

Students will integrate and solidify topics of professional communications, ethics, problem solving, and fundamental competencies of engineering. Students will enhance their understanding of consequences of engineering, design issues, legal aspects, ethical considerations, management, and leadership, through readings, research, and discussions.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand
Restrictions: Permission of department required
Pre-Requisite(s): ENG 1101 or ENG 1101T or (ENG 1001 and ENG 1100) and ENG 1102 and ENG 2120 or (MEEM 2110 and MEEM 2150) and (ENG 3200 or CEE 3200) or (MEEM 2201 and MEEM 3201) and (EE 3010 or EE 2112) and (CEE 3101 or CS 1121 or ENG 2505 or GE 2300 or MSE 2100) and (CEE 3332 or GE 3880 or MEEM 3600)

ENG 3990 - Special Topics in Engineering

Engineering topics of interest to students and faculty that are not normally covered in the existing courses.
Credits: variable to 5.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required

ENG 4060 - Leadership in Group Environments

Develops collaborative leadership skills through active hands-on learning. Topics include collaborative software, communication, and group management strategies.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ENG 4070 - Peer Mentoring Practicum

Experience designed for the practical application of leadership knowledge, skills, and behaviors acquired in the LEAP program or mentoring environment. The practicum experience will be designed and implemented by the student, with mentorship/guidance from the associated faculty.
Credits: 3.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): ENG 3060

ENG 4300 - Project Management

The various stages in a project life cycle will be covered and include initiation, planning, execution, and closeout. Basic tools such as the Project Charter, Network Diagrams Gantt, and budgeting will be covered. Basics of MS Project are included.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BUS 2100 or CEE 3710 or MA 2720 or MA 3710 or EE 3180 or BE 2110 or MA 2710 or PSY 2720

ENG 4505 - Systems Analysis, Modeling, and Design

This course will focus on a cross disciplinary subset of systems drawn from engineering, business, and natural science. Students will concentrate on modeling methodology appropriate for moderate to large systems environments and a collaborative project where they apply what they have learned.
Credits: 3.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): ENG 2505 and ENG 3505(C)

ENG 4515 - Introduction to Sustainability and Resilience

Introduction to sustainable development, resilience, and global grand challenges with emphasis on socio-technical systems. Key topics include earth systems literacy, policy development, corporate social responsibility, ecological economics, sustainability indicators, and industrial/societal applications (e.g. agricultural, mining sustainability, etc,).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

ENG 4525 - Systems Analysis for Sustainability and Resilience

In-depth coverage of systems analysis using advanced tools and methods. Topics will include environmental life cycle assessments, social life cycle assessments, techno-economic assessments, material flow analysis, industrial ecology, and regional economic assessments.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

ENG 4900 - Multidisciplinary Senior Design Project I

Introduction to engineering design, including modeling, simulation, economic decision making, and reliability. Integration of design principles in the solution of open-ended engineering problems. Projects are defined and planned with faculty and industrial guidance. Emphasizes economics and environmental constraints. Students must be Senior Project ready as defined by major.
Credits: variable to 4.0
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

ENG 4905 - Senior Engineering Design Project

Students work in teams on one-semester open-ended capstone design projects developing and implementing original and creative solutions to real engineering problems. Students must be Senior Project ready as defined by major. May take ENG4905, ENG4900, or ENG4910.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ENG 2120 or (MEEM 2110 and MEEM 2150) and (ENG 3200 or CEE 3200) or (MEEM 2201 and MEEM 3201) and (EE 3010 or EE 2112) and (CEE 3101 or CS 1121 or ENG 2505 or GE 2300 or MSE 2100) and (CEE 3332 or GE 3850 or MEEM 3600 and ENG 3830(C) or (ENG 3505 and ENG 4505))

ENG 4910 - Multidisciplinary Senior Design Project II

Continuation of ENG4900. Introduction to engineering design including modeling, simulation, economic decision making and reliability. Integration of design principles in the solution of open-ended engineering problems. Projects are defined and planned with faculty and industrial guidance. Emphasizes economics and environmental constraints. (Senior project ready as defined by major substitutes for prerequisites)
Credits: variable to 4.0
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ENG 4900

ENG 4990 - Special Topics in Engineering

Engineering topics of interest to students and faculty that are not normally covered in the existing courses.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required

Enterprise

ENT 1900 - Enterprise Explorations

Introduction to the Enterprise program, project-based learning, and interdisciplinary teams. Includes hands-on exploration of the various enterprises and curricular options available. Specifically for first-year students.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

ENT 1960 - Enterprise Orientation-Spring

An orientation for students to their specific enterprise. Covers enterprise specific topics but should also include organizational structure; past, present and future projects and their results.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

ENT 2950 - Enterprise Project Work I

Interdisciplinary teams work as part of an enterprise to address real-world design projects or problems. Second-year students are responsible for achieving some prescribed objectives, as defined by their Enterprise team.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ENT 2960 - Enterprise Project Work II

Interdisciplinary teams work as part of an enterprise to address real-world design projects or problems. Second- year students are responsible for achieving some prescribed objectives, as defined by their Enterprise team.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ENT 2961 - Teaming in the Enterprise

Develops group problem-solving skills. Stresses interpersonal skills and skill assessment, communication, group process and teamwork, and action planning. Uses active, hands-on learning.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ENT 2962 - Communication Contexts

An introduction to the demands of technical and professional communication in workplace settings, through analyzing project design team experiences.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

ENT 3950 - Enterprise Project Work III

Interdisciplinary teams work as part of an enterprise to address real-world design projects or problems. Third-year students will practice designing approaches to solve problems and develop procedures to achieve specified project objectives.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3953 - Ignite: Ideate, Innovate, Create!

Whether starting a business or working for an established company, creativity and innovation are keys to success. Course will explore creativity tools and techniques such as design thinking and human centered design to help generate ideas that provide value to society.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

ENT 3954 - Enterprise Market Principles

Examines the fundamental principles of marketing in the six stages of product life cycle (opportunity identification, product development, introduction, growth, maturity, and decline).
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

ENT 3956 - Industrial Health and Safety

Instruction of health and safety in engineering practice. Integrates the study of health and safety regulations, risks, and potential for improvement. Also covers the tremendous financial, ethical, and public relations implications of disregarding this critical aspect of engineering.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

ENT 3958 - Ethics in Engineering Design and Implementation

The focus of this course is on ethical considerations in the engineering design and implementation process. Basic ethical analysis tools will be explored through various exercises. Students will analyze and present life engineering ethics case studies.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior
Pre-Requisite(s): ENG 1101 or ENG 1101T

ENT 3959 - Fundamentals of Six Sigma I

This course introduces tools used for process improvement focusing on the DMAIC approach used widely in industry today.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

ENT 3960 - Enterprise Project Work IV

Interdisciplinary teams work as part of an enterprise to address real-world design projects or problems. Third-year students practice designing approaches to solve problems and develop procedures to achieve specified project objectives.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3961 - Building and Leading Teams

This 1-credit module focuses on exploring research findings about leadership, the practice of leadership, and providing skill assessment and development opportunities. Topics include leadership traits, behaviors, theories, and leadership of change. Combines a variety of teaching methods, including self-assessment, cases, discussion, experiential exercises, role-playing, videotaping.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

ENT 3963 - Deliver: Explore, Develop, Execute!

if you have an idea that you believe addresses a need and could lead to commercialization, this course will help you to explore the path from idea to market through customer development, value assessment, business model planning, and execution.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

ENT 3964 - Fundamentals of Project Management

Project definition, developing a work breakdown structure, responsibility assignment and milestone development. Covers techniques for project scheduling and practical application of Gannt and PERT/CPM charts; resource management and application of critical chain method; project budgeting and cost estimation; project monitoring, control, evaluation, and termination; and project teams, their structure, and interactions.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3965 - Automotive Engineering

Automotive systems engineering and fundamental operating principles including powertrain/propulsion, on-board energy usage, chassis systems, manufacturing, and future application. Course will explore fundamental engineering decisions behind specific automotive, on/off road, and heavy duty vehicles and components.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Spring, Summer

ENT 3966 - Design for Manufacturing

This course supplements courses that address "design for function." Products "designed for manufacturing" are lower cost, higher quality, and have a shorter time to market. The course describes how the capabilities and limitations of common manufacturing processes translate into qualitative design guidelines. Topics include design for casting, forging, sheet metal forming, machining, plastics and assembly.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): ENG 1102

ENT 3967 - Design for Six Sigma

This course emphasizes the design for Six Sigma (DFSS) tools and methods used widely in industry to optimize new products and services.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

ENT 3970 - Enterprise Special Topics

For the development of new, junior-level instructional modules in support of the enterprise.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Junior, Senior

ENT 3971 - Seven Habits of Highly Effective People

Focuses on personal and professional effectiveness through greater productivity, increased influence in key relationships, stronger team unity and complete life balance. This course will explore these areas through interactive exercises, case studies, videos, and sharing of experiences.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

ENT 3979 - Alternative Energy Technologies and Processes

This course covers a wide range of alternative energy technologies with an emphasis on chemical and biochemical processing. Technologies covered may include biofuels, solar power, fuel cells, etc.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

ENT 3980 - Pre-Capstone Enterprise Project Work

Interdisciplinary teams work as part of an enterprise to address real-world design projects or problems. This course is to be taken by third-year or fourth-year enterprise students who have completed the junior-level project work, but are not approved as capstone-ready by their department.
Credits: 1.0; Repeatable to a Max of 2
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): ENT 3950 and ENT 3960

ENT 3981 - LabVIEW Basics

Learn how to program LabVIEW, a popular data acquisition and automation language used by engineers. Programming is done graphically which makes it easy to learn and use. Some of the topics covered: LabVIEW environment, how to construct graphical user interfaces, loops, debugging, writing data to disk and an intro to data acquisition.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring

ENT 3982 - Continuous Improvement Using Lean Principles

Fields from engineering through the social sciences are adopting continuous improvement using Lean principles to make their organizations successful. The evolution of these principles and the associated processes, methods, and tools are described and applied.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall

ENT 3983 - The Culture of Continuous Improvement

A continuous improvement culture is based on humility and respect for people. Problem solving in this environment is highly participative, focuses on the issue not the person, and seeks to empower the employees closest to the work being performed.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring

ENT 4900 - Senior Enterprise Project Work V Non-Capstone

Interdisciplinary teams work as part of an enterprise to address real-world projects or problems of significance to industry, government and communities. Fourth-year students gain experience in defining project objectives and planning strategies to achieve these objectives, and leading teams to accomplish project goals. This course is for students who are not participating in Enterprise to fulfill their capstone requirements.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Senior

ENT 4910 - Senior Enterprise Project Work VI Non-Capstone

Interdisciplinary teams work as part of an enterprise to address real-world projects or problems of significance to industry, government and communities. Fourth-year students gain experience in defining project objectives and planning strategies to achieve these objectives, and leading teams to accomplish project goals. This course is for students who are not participating in Enterprise to fulfill their capstone requirements.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Senior

ENT 4950 - Enterprise Project Work V Capstone

Interdisciplinary teams work as part of an enterprise to address real-world design projects or problems, taking constraints into account and applying relevant standards. Fourth-year students gain experience in defining project objectives, planning strategies to achieve these objectives, and leading technical teams to accomplish project goals. Must be project ready as defined by major.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Biomedical Engineering, Engineering, Civil Engineering, Geospatial Engineering, Chemical Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Geological Engineering, Mechanical Engineering, Materials Science and Engrg, Robotics Engineering, Software Engineering, Construction Management, Computer Network & System Admn, Electrical Eng Tech, Mechanical Engineering Tech, Surveying Engineering, Information Technology; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): (BE 3350 and BE 3700 and BE 3800 and BE 4900 and ENT 3950 and ENT 3960) or (CEE 3620 or CEE 3810) or CM 4855(C) or (CS 3712 or CS 4711 or CS 4760) or (ENT 3960 and EE 3131) or (EE 3280 and EE 3261(C)) and EE 3910 and (EE 3174(C) or EE 3171(C) or EE 3173(C)) or (GE 3890 and GE 3880) or (ENT 3950 and ENT 3960) and (MA 3710(C) or MA 2710(C) or MA 2720 or MA 3715) and (MEEM 3750 or ME 3750) and (MEEM 3201 or ME 3201) and (MEEM 3901 or ME 3901) and (MEEM 3911 or ME 3911) and EE 3010(C) and (MEEM 3400 or ME 3400) and (MEEM 3600 or ME 3601(C)) or MSE 3190 or (CMG 3250 and CMG 4120(C) and CMG 4210 and CMG 3200) or (EET 3281 and EET 4253(C)) or SAT 3812(C) or SU 4100(C) or ENG 3505(C) or (ENT 3950 and ENT 3960) or (MET 4200 and MET 3500(C) and MET 3451(C)) or MET 4210

ENT 4960 - Enterprise Project Work VI Capstone

Interdisciplinary teams work as part of an enterprise to address real-world design projects or problems, taking constraints into account and applying relevant standards. Fourth-year students gain experience defining project objectives, planning strategies to achieve these objectives, and leading technical teams to accomplish project goals.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): ENT 4950 and (BE 4900 or CEE 3620 or CEE 3810 or CM 4855 or CS 3712 or CS 4711 or CS 4760 or (EE 3174 or EE 3171 or EE 3173) or GE 3890 or GE 3880 or MSE 4141(C) or CMG 4210 or (EET 4253 and EET 3281) or (MET 4460 and MET 4210) or (SAT 4541 and SAT 3812) or SU 4100 or ENG 3830(C) or (ENG 3505 and ENG 4505) or (MEEM 3750 or ME 3750) and (MEEM 3201 or ME 3201) or (EE 3280 and EE 3261))

ENT 4961 - Enterprise Project Work VII

Course intended for students who have completed all project courses in Enterprise and who wish to continue with the program through graduation.
Credits: 1.0; Repeatable to a Max of 2
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): ENT 3950 and ENT 3960 and (ENT 4950 and ENT 4960) or (ENT 4900 and ENT 4910)

ENT 4970 - Enterprise Special Topics

For the development of new, senior-level instructional modules in support of the enterprise.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior

Finance

FIN 2400 - Financial Literacy

Developing fluency with consumer financial decisions. Topics include goal setting, budgeting, financial disclosures, interest rate mathematics, funding major purchases, credit and loan matters, savings and investment opportunities, taxation, retirement plans and insurance protection, with an emphasis on evaluating financial alternatives.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

FIN 3000 - Principles of Finance

Introduction to the principles of finance. Topics include financial mathematics, the capital investment decision, financial assets valuation, and the risk-return relationship
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): ACC 2000 and (MA 1020 or MA 1030 or MA 1031 or MA 1032 or MA 1120 or MA 1135 or MA 1160 or MA 1161 or MA 1121 or MA 2160 or ALEKS Math Placement >= 61 or CEEB Calculus AB >= 2 or CEEB Calculus BC >= 2 or ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540)

FIN 4000 - Investment Analysis

Overview of financial products. Operations of the stock market, bond market, and other financial markets. Focus on portfolio theory and basic stock and bond valuation techniques.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EC 3400 or FIN 3000 and (MA 2710 or MA 2720 or MA 3710)

FIN 4100 - Advanced Financial Management

Advanced topics in managerial finance: Advanced capital budgeting, project analysis, capital acquisition, capital structure and dividend policy, and other topics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): EC 3400 or FIN 3000

FIN 4200 - Derivatives and Financial Engineering

Covers the pricing and use of options, financial futures, swaps, and other derivative securities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): EC 3400 or FIN 3000 and (MA 2710 or MA 2720 or MA 3710)

FIN 4300 - Personal Financial Planning

Overview of personal financial issues and services and instruments offered by economic and financial institutions. Topics include the personal financial environment, personal investments and asset management, tax planning, the development of an adequate but cost-effective insurance program, and retirement planning.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BA 3400 or EC 3400 or FIN 3000

FIN 4400 - Equity Analysis

Detailed analysis of equity valuation, including applications and processes, estimation of valuation assumptions, absolute valuation models (dividend discounting, free cash flow and residual income) and relative valuation models (market-based), with a focus on practice-based techniques.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): FIN 3000 or EC 3400

FIN 4500 - Risk Management

Understand risk and tools for analyzing risk in business. Includes topics such as capital management, bankruptcy, insurance and hedging strategies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (FIN 3000 or EC 3400) and (MA 2710 or MA 2720 or MA 3710 or MA 3720)

FIN 4600 - FinTech Foundations

FinTech is technology that provides financial markets products and services using bleeding-edge technology. Topics include digital banking, currency, and payment systems; algorithmic trading and roboadvising, and techs specializing in API, credit, insurance, investment intelligence, lending, and regulation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): EC 3400 or FIN 3000

FIN 4700 - Global Finance

Studies international financial systems and markets. Covers the principle of comparative advantage, balance of payments, exchange rate systems, theories of international finance, identification of international risk exposures, the management and treatment of risk, and special topics of international finance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BA 3400 or EC 3400 or FIN 3000

FIN 4801 - Applied Portfolio Management I

Covers issues in the management and administration of investments in an institutional setting. Students form a new investment firm and manage a real portfolio of financial assets.
Credits: variable to 3.0
Semesters Offered: Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

FIN 4802 - Applied Portfolio Management II

Covers issues in the management and administration of investments in an institutional setting. Students form a new investment firm and manage a real portfolio of financial assets.
Credits: variable to 3.0
Semesters Offered: Fall
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

FIN 4803 - Applied Portfolio Management III

Covers issues in the management and administration of investments in an institutional setting. Students form a new investment firm and manage a real portfolio of financial assets.
Credits: variable to 3.0
Semesters Offered: Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

FIN 4990 - Special Topics in Finance

Examines current issues in Finance and other topics of interest to faculty and students in greater depth.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Pre-Requisite(s): EC 3400 or FIN 3000

Forest Resources & Environmental Sciences

FW 1020 - Exploring College of Forest Resources and Environmental Science Opportunities

An exploration of the majors, minors, and other opportunities available in the College of Forest Resources and Environmental Science and Michigan Tech. Students will develop a plan to reach their academic and career goals.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

FW 1035 - Wood Anatomy and Properties

An introduction to the anatomical and physical nature of woody materials and how these characteristics are related to its applications as a sustainable raw material.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring

FW 1050 - The Natural Resource Professional

Seminar introduces students to the various careers within forestry, conservation, ecology, and wildlife that represent specialties within natural resources. Students explore natural resource issues around the world, and practice effective written and communication skills.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall

FW 2010 - Vegetation of North America

Identification and life history of trees, shrubs, and common understory plants of the major forested vegetation types of North America. Including plant morphology, taxonomy, life history traits, and community ecology of trees and forests.
Credits: 4.0
Lec-Rec-Lab: (2-0-4)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of For Res & Env Sci

FW 2015 - Landscape Vegetation

Urban forests typically exhibit much greater species diversity of trees and shrubs than do native forests. Landscape vegetation focuses on identifying the many non-native, introduced, and ornamental trees found in communities, as well as the invasive woody species that create problems.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): FW 2010

FW 2030 - Conservation of Nature

This course explores the history and evolution of conservation in thought and practice, with an emphasis on the writings and legacy of conservation pioneers such as Aldo Leopold.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

FW 2051 - Field Techniques

Equipment and techniques used in forestry, wildlife, ecology, and recreation management. Topics include field safety, land measurement and navigation, establishment of sample locations, measurement of attributes of individuals and groups of trees, vegetation and other organisms.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall

FW 2060 - Fundamentals of Environmental Sustainability

The four scientific principles of sustainability (reliance on solar energy, biodiversity, nutrient cycling, population control) are the foundation of the course. The course applies basic principles of physics, chemistry, and biology and a systems approach to provide students with a fundamental understanding of how the environment functions and strategies for sustaining natural resources.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

FW 2081 - Introduction to Circular Economy

The circular economy is an emerging cross disciplinary field of study that maps a transition from current linear and unsustainable practices, role of consumers, policy, business models, bioeconomy, design, innovation and technological accelerators.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

FW 2100 - Introduction to Biochemistry

This course provides a basic knowledge of biochemical processes underlying cellular mechanism in living organisms. It examines the chemical nature of cellular components in plants and animals by relating the structure and function of macromolecules to their effects on the whole system level.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): CH 1150

FW 2801 - Introduction to Global Climate Change

Causes, consequences, and solutions to the issue of global climate change. Focus on evaluating potential solutions to problems arising from climate change. Intended to provide students from diverse academic backgrounds with an understanding of the issue and to provide multidisciplinary context for students pursuing further study of climate change.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

FW 2995 - Current Issues in Natural Resources

Covers timely issues in natural resources research, planning, or management as specified by section title.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand

FW 3010 - Practice of Silviculture

Methods of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis. Course held at Ford Center, Alberta, MI.
Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Forestry, Wildlife Ecology & Mgmt, App Ecol & Environ Sci
Pre-Requisite(s): FW 2010 and FW 2051

FW 3012 - Survey of Silviculture

An introduction to the practice of silviculture including ecological principles which form the basis for forest management. The course emphasizes proper use of silviculture terminology and includes field examples of management practices. Course held at Ford Center, Alberta, MI.
Credits: 2.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, Natural Resources Management, Wildlife Ecology & Cons, App Ecol & Environ Sci, Forestry
Pre-Requisite(s): FW 2010 and FW 2051

FW 3015 - Arboriculture

The establishment and care of trees and shrubs including urban forests in diverse landscapes. Topics include species selection, soil science, nutrition and fertilization, plant health care, pruning, tree risk assessment, and climbing and working in trees.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

FW 3020 - Forest Ecology

Environmental factors and plant and animal characteristics which control composition, structure, and function of forest ecosystems. Emphasis on how ecosystems change across space and time and knowledge needed to sustainably manage forest ecosystems for social, economic, and ecological benefits.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): FW 2051(C)

FW 3075 - Introduction to Biotechnology

The course covers basic concepts and practical applications in biotechnology. Topics include the use of biotechnology in agriculture, healthcare, and environmental remediation. Advances in gene containment, regulatory, societal and environmental issues associated with commercialization of biotechnological products will be discussed.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

FW 3090 - Mechanics of Solid Wood and Wood Composites

An overview of the mechanical properties of wood that are related to engineering and structural applications of lumber, timber, and wood composite panels.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of For Res & Env Sci, College of Engineering; May not be enrolled in one of the following Class(es): Freshman

FW 3097 - Forest Biomaterials

Examines the nature and use of forest biomaterials and their role in the larger economy. Local and global advantages and challenges for using forest biomaterials will be addressed within the context of sustainability, covering topics such as economics, material and product engineering, policy, life cycle analysis, and supply chain management.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

FW 3098 - Adding Value to Forest Biomaterials

Examines how forest biomaterials are converted from raw forms into intermediary or final products that can support a sustainable future. Manufacturing sites in the upper Midwest are visited during the week prior to the start of fall semester. Lecture topics include the forest bioeconomy, emerging and export markets, and industry challenges.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall, in even years
Pre-Requisite(s): FW 1035

FW 3110 - Natural Resource Policy

Covers concepts related to social systems and natural resources. Explores natural resource policy foundations and partners, rights and responsibilities, and approaches and practices within and between state, tribal, and federal levels of policy making, policy processes, implementation, and evaluation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer

FW 3111 - Wild Foods: Northern Forests

This class engages students online and in the field in learning practical skills utilizing vegetation of the northern forest for food, medicines, and utilitarian purposes. The course provides a basic overview of cultural and historical importance of the interactions between people and plants.
Credits: 2.0
Lec-Rec-Lab: (1-0-1)
Semesters Offered: Summer, in even years

FW 3112 - Human Dimensions of Conservation

Integration of competing stakeholder objectives affects wildlife conservation and management outcomes. Federal law including the Endangered Species Act (ESA), domestic and international treaties, and Traditional Ecological Knowledge (TEK) are introduced.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following College(s): College of For Res & Env Sci; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FW 1050

FW 3114 - Reading the Forest

An international ecologically-focused travel course emphasizing observational learning. Students study forest ecology topics and various natural disturbance and human-derived impacts that shape forests around us. Connecting to the natural world and place-based learning influences the way we make observations.
Credits: 3.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Summer, in odd years
Restrictions: Permission of instructor required
Co-Requisite(s): FW 3117

FW 3117 - Forest of the Future: Swedish Study Abroad

International travel course based in Sweden that links together climate change, tree physiology, and how we interact with and communicate about forests. Students will learn about and practice modes of science communication. The course runs in Summer session and includes 3 weeks abroad, 5 weeks of online engagement, and before and after travel.
Credits: variable to 3.0
Semesters Offered: Summer, in odd years
Restrictions: Permission of instructor required
Co-Requisite(s): FW 3114

FW 3150 - Timber Harvesting

Methods and techniques used in lake states timber harvesting systems. Introduces best management practices, aesthetic and ecological impacts, logging cost analysis, timber appraisal, and timber sale preparation and administration. Course held at Ford Center, Alberta, MI.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Forestry
Pre-Requisite(s): FW 2051

FW 3170 - Land Measurements and GPS

Introduces field measurements and computations involved in determining direction, distance, and area. Covers the hand compass, pacing, and use of GPS, including differential correction. Integration of GPS data with GIS is emphasized. Course held at Ford Center, Alberta, MI.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, Natural Resources Management, Wildlife Ecology & Cons, App Ecol & Environ Sci, Forestry
Co-Requisite(s): FW 3190
Pre-Requisite(s): FW 3540

FW 3180 - Geomorphology, Landscapes and Ecosystems

Provides basic understanding of the geologic and glacial processes that shaped the landscape of the Upper Midwest influencing the distribution and productivity of modern-day plant communities. Topics include geology of Michigan, glacial geomorphology, soil development, landscape and community ecology, and forestry. Course held at Ford Center, Alberta, MI.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, Wildlife Ecology & Cons, App Ecol & Environ Sci, Natural Resources Management; May not be enrolled in one of the following Class(es): Freshman

FW 3190 - Multi-resource Assessment

Develops a basic proficiency in the application of multiple-resource measurement techniques. Gain familiarity with the application of individual tree and landscape measurements as well as estimation of growth, sampling techniques, computational procedures, and mapping procedures commonly used in forest and land management. Course held at Ford Center, Alberta, MI.
Credits: 3.0
Lec-Rec-Lab: (0-1-4)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, Natural Resources Management, Wildlife Ecology & Cons, App Ecol & Environ Sci, Forestry
Pre-Requisite(s): FW 2051 and FW 3020 and FW 3200 and (MA 2710 or MA 2720 or MA 3710)

FW 3200 - Biometrics and Data Analysis

Sampling design, implementation and analysis for inventory and monitoring of attributes of stands, forests and landscapes. Includes computing skills for data entry, storage and analysis and application of statistical techniques to answer questions about ecological data.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring, Summer
Pre-Requisite(s): FW 2051 and (MA 2710 or MA 2720 or MA 3710)

FW 3313 - Sustainability Science

Foundational scientific concepts (dynamic systems and catastrophe theory) as applied to socioecological systems. Use of indicators and indices to track progress towards sustainability goals. Review of local, national, and global sustainability policies to avoid catastrophes and guide sustainable development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring

FW 3320 - Fundamentals of Forest Genetics and Genomics

This course will teach fundamental and applied genetic principles that are essential for management of forest and other ecosystems to maintain their long-term health and sustainability. The class will cover the following topics: structure and function of DNA, inheritance, molecular evolution, population and quantitative genetics, gene conservation, genomics and biotechnology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1400 or BL 2160

FW 3330 - Soil Science

Introduction to the chemical, physical, and biological properties of soil.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Pre-Requisite(s): CH 1112(C) or (CH 1150(C) and CH 1151(C))

FW 3376 - Forest & Environmental Resource Management (The FERM) I

Application of forest and environmental management practices by teams of students with the assistance of faculty, staff and local and regional partners.
Credits: 2.0; May be repeated
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): FW 2010 and FW 2051

FW 3410 - Conservation Science

Introduction to biological, social, political, and economic facets of conservation science. Evaluating how best to maintain and restore species, populations, and ecosystems. Topics include human impacts on ecosystems, how science informs strategies, conservation challenges, policy, planning, structured decision making.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

FW 3510 - Outdoor Recreation and Tourism

Covers background on Americans and leisure; overview of primary providers of recreation in the US; management of outdoor recreation, measuring and valuing outdoor recreation and tourism; recreation and tourism in the Great Lakes region. Requires participation in field trips/workshops.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Spring

FW 3540 - An Introduction to Geographic Information Systems for Natural Resource Management

The fundamentals of GIS and its application to natural resource management. Spatial data, its uses and limitations are evaluated. Students work extensively with the ARCGIS software package.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Pre-Requisite(s): MA 2710(C) or MA 2720(C) or MA 3710(C) or ENVE 3502 or CEE 3502(C)

FW 3600 - Wildlife Habitat

Understand the ecological basis for management of forest wildlife and how forest management influences wildlife populations. Laboratory introduces techniques in wildlife research and management, especially methods of habitat analysis. Course held at Ford Center, Alberta, MI.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, Natural Resources Management, Wildlife Ecology & Cons, App Ecol & Environ Sci, Forestry; May not be enrolled in one of the following Class(es): Freshman

FW 3601 - Wildlife Research Techniques

Techniques used by managers and researchers when working with wildlife. Scientific method, scientific writing, and principles of study design are introduced.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Cons; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FW 2051(C)

FW 3610 - Ornithology

An ecological and evolutionary approach to the study of birds. Topics include behavioral, anatomical, and physiological adaptations to flight, life history, mating systems, migration, communication and conservation. Laboratory emphasizes identification and experimental use of birds as model organisms.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Pre-Requisite(s): BL 1040 or BL 1020 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

FW 3620 - Field Ornithology

An introduction to field techniques and identification. Weekend trip to Whitefish Point Bird Observatory during spring migration and field note taking.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Summer

FW 3760 - Human Dimensions in Natural Resources Stewardship

Uses sociological concepts to enhance understanding of shared natural resource stewardship regimes, including human-environment relationships, beliefs and values, rights and responsibilities associated with sovereignty; and the diversity of knowledge systems and expertise related to natural resource practices and policies.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

FW 3766 - Maple Syrup Management and Culture

Overviews cultural and historical importance of syrup production. Topics include methods of collecting and processing sap, syrup, sugar, and business marketing of maple products. Course includes lab experience at Nara Family Maple Center.
Credits: 3.0
Lec-Rec-Lab: (1-1-1)
Semesters Offered: Spring

FW 3800 - Insect Ecology

Insects are widespread and diverse components of terrestrial and aquatic ecosystems. This course will consider aspects of insect ecology, including biodiversity and conservation of insects, the effects of biotic and abiotic factors on insect populations, and the trophic diversity of insects. Course held at Ford Center, Alberta, MI.
Credits: 2.0
Lec-Rec-Lab: (1-1-0)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, Wildlife Ecology & Cons, App Ecol & Environ Sci, Natural Resources Management

FW 3840 - Forest Health

Drawing on examples from the Great Lakes region, and other parts of North America, this course will consider which type of insects and pathogens attack our trees and forests, how they interact with each other, and what tools we can use to effectively reduce their negative impacts of forest pests. Course held at Ford Center, Alberta, MI.
Credits: 3.0
Lec-Rec-Lab: (1-1-3)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, Natural Resources Management, Wildlife Ecology & Cons, App Ecol & Environ Sci, Forestry
Pre-Requisite(s): FW 3020

FW 3850 - Animal Behavior

Examines how animal behavior is shaped by developmental and evolutionary processes. Explores the effects of inheritance, environment, and intra-and inter-species interactions on on animal behavior.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Spring, Summer, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1040 or (BL 1400 and BL 1410) or BL 1010 or (BL 1100 and BL 1110) and (BL 1020 or BL 1200 and BL 1210)

FW 4000 - Professional Experience Program

Students create oral/written reports and reflection based on paid or volunteered work or field experience in natural resources.
Credits: 1.0; Repeatable to a Max of 4
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required

FW 4001 - Bioproducts Internship

Provides a directed work experience related to sustainable bioproducts. Requires a detailed proposal and written summary product.
Credits: variable to 3.0; Repeatable to a Max of 3
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following College(s): College of For Res & Env Sci; Must be enrolled in one of the following Major(s): Sustainable Bioproducts; May not be enrolled in one of the following Class(es): Freshman

FW 4050 - Deterioration and Preservation of Sustainable Biomaterials

Biological factors causing degradation of wood and the technologies for preservation and protection of wood-based materials.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

FW 4070 - Ge-izhi-mawanji'idiyang dazhindamang gidakiiminaan (the way we meet to talk about our earth)

This course invites Ojibwa community guests to share cultural, ecological, and governance knowledge with students who will develop a better understanding of our shared environment, career and higher education opportunities, and will be better prepared for engaging with and as natural resource and environmental science professionals.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, in even years

FW 4080 - Forest Economics & Finance

Financial analysis and economic theory applied to forestry project analysis and selection, focusing on prices. Covers risk, capital markets, taxation, auctions, and non-market valuation.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

FW 4082 - Gene Expression Data Analysis

This course is designed for students majoring in molecular biology, computer science, data science and related majors to develop fundamental but essential skills for manipulating, preprocessing, and analyzing high throughput gene expression data for pattern extraction and knowledge discovery.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): FW 4099 or CS 1121 or CS 1122 or CS 1131 or CS 1141 or CS 2321

FW 4099 - Programming Skills for Bioinformatics

Students will learn computer programming skills in Perl for processing genomic sequences and gene expression data and become familiar with various bioinformatics resources.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): CS 1121

FW 4111 - Indigenous Natural Resource Management

In this course, students gain knowledge in indigenous history, culture, and policy to enhance understanding of the rights and privileges associated with treaties, government-to-government relationship, and diversity of people, practices and values. Students engage in multidisciplinary scholarship with relevance for today's shared management regime.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

FW 4115 - Tree Seedling Production and Greenhouse Management

Covers how plants are grown from seed and vegetative propagules like cuttings. Topics include principles and techniques involved in raising plants for garden, horticulture, and forestry uses. Traditional and modern techniques will be covered. Students gain hands-on experience in greenhouse management.
Credits: 3.0
Lec-Rec-Lab: (1-0-5)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

FW 4120 - Tree Physiology

A study of tree structure, growth, development and function, and how these are related to the environment. We will focus on the cycling of water, carbon, and nutrients within the context of global change.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

FW 4128 - Conservation Genetics

This course will explore molecular methods as they apply to conservation, management, ecology, and evolution of wildlife. We will emphasize laboratory techniques and the application of genetic theory.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1040 or BL 1020 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

FW 4140 - Stand & Forest Modeling

Use of models that simulate tree, stand, and forest development. Emphasis on critical evaluation of model designs, outputs, uses in silvicultural decision-making, and forest to landscape management and planning.
Credits: 2.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): FW 3010 or FW 3012 and FW 3540(C)

FW 4150 - Forest and Natural Resource Management

Focuses on forest and natural resources management planning and decision making. Emphasizes structured problem solving frameworks and decision support tools/models. Three field trips to meet with natural resources professionals and discuss site-specific management issues and approaches.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): FW 3010 or FW 3012

FW 4180 - Applied Environmental Ethics

Discusses relationship between ecological science and environmental ethics as it relates to natural resource management, conservation and sustainability.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following College(s): College of For Res & Env Sci; May not be enrolled in one of the following Class(es): Freshman, Sophomore

FW 4220 - Wetlands

Study of the physical, chemical, and biological characteristics of wetlands. Describes functions and values of individual wetland types. Presents management of wetlands and laws governing wetlands. Labs concentrate on field techniques used to assess specific plant, animal, soil, and hydrological characteristics of wetlands.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): BL 1100 or BL 1400 or BL 2160 or BL 3080

FW 4240 - Mammalogy

Exploration of mammal evolution, taxonomy, adaptions, and life histories. Through discussions, labs, and fieldwork, students will gain practical experience in identifying mammals, with an emphasis on western Great Lakes species, while developing a broader understanding of global mammalian biodiversity.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 1020 or BL 1040 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

FW 4260 - Population Ecology

Covers the principles of population ecology. Topics include measures of populations, population dynamics, and models used to describe the theories related to population dynamics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

FW 4300 - Wildland Fire

Overview of wildland fire based on an understanding of fire history, fuel properties, fire weather, fire behavior, ecological effects and management.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): FW 3020 and (FW 3010 or FW 3012)

FW 4370 - Forest and Landscape Hydrology

The course will use a process-based approach to present the physical hydrology, geomorphology and water quality of forested watersheds. Course focuses on the interaction between watershed processes and forest management.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

FW 4371 - Snow Hydrology

This course will cover snow formation in the atmosphere, snow accumulation and distribution, snow metamorphism, avalanche dynamics, snowmelt and runoff, remote sensing of snow properties, and the impact of forests and under-snow biogeochemical processes.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MA 2710 or MA 2720

FW 4380 - Landscape Ecology and Planning

Basic principles of landscape ecology, including pattern, process, and scale. Students will learn how to use quantitative tools to study landscape-scale patterns and processes, and how to apply these principles and tools to conservation, resource management, and planning issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 2720 or CEE 3502

FW 4400 - Urban Forestry

Urban forestry is the science and art of managing natural resources in communities. It focuses on maximizing the wide range of economic, environmental, and social benefits associated with trees and urban greenspaces while minimizing maintenance costs and reducing tree-related risks.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

FW 4421 - Climate Change and Forested Systems

Provides an overview of climate change science, effects and adaptation. Students develop knowledge of climate change effects and adaption for real world forested ecosystem examples and learn how to communicate these climate change projects and plans with stakeholders.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

FW 4500 - Independent Study

Guided study or research on an approved forest resource or other natural resource topic with a chosen faculty member.
Credits: variable to 7.0; Repeatable to a Max of 7
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

FW 4540 - Remote Sensing of the Environment

Remote sensing principles and concepts. Topics include camera and digital sensor arrays, types of imagery, digital data structures, spectral reflectance curves, applications, and introductory digital image processing.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

FW 4545 - Map Design with GIS

Principles of making maps, from traditional to advanced visualization techniques, that convey information which is useful in decision making at many levels. Focus will be on creating maps using GIS software and digital data. A working knowledge of ArcGIS is required.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): FW 3540 or FW 5550

FW 4550 - Introduction to Cartography for GIS

Principles of making maps, from traditional to advanced visualization techniques, that convey information which is useful in decision making at many levels. Focus will be on creating maps using GIS software and digital data. A working knowledge of ArcGIS is required.
Credits: 3.0
Lec-Rec-Lab: (1-1-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): FW 5550 or FW 3540

FW 4554 - GPS Field Techniques

This course will provide hands-on experience with various types of GPS units and different applications of the technology. These applications include planning, data collection, data processing, and data management. Emphasis will be on practical applications of Global Positioning System technology.
Credits: 2.0
Lec-Rec-Lab: (1-0-1)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of For Res & Env Sci; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): FW 3540

FW 4610 - Wildlife Ecology

Covers the ecological basis for management of wildlife, including biological and sociological factors that influence management.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 3400(C) or FW 3020(C)

FW 4620 - Herpetology

The biology of amphibians and reptiles, including evolution, zoogeography, ecology, behavior and physiology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): BL 1040 or BL 1020 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

FW 4635 - Wildlife Disease Ecology

Covers the ecology of wildlife disease including interactions of host physiology, behavior, pathogen biology, and environment in the transmission and evolution of diseases in wildlife populations. Discusses the role of disease management in conservation and the effects of global environmental change on disease dynamics and public health.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): FW 3601 or FW 4610 or BL 3940

FW 4710 - Environmental Biogeochemistry

Impacts of decisions regarding land use, land management, and energy and mineral exploration on natural resources (i.e., air, water, land, and biodiversity) are discussed using the framework of the biogeochemical cycles of the elements.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1150

FW 4800 - Communication for Natural Resource Professionals

This class completes the development of oral and written communication skills for students as they prepare to graduate and gain employment in the field of natural resources.
Credits: 2.0
Lec-Rec-Lab: (1-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): FW 3190

FW 4811 - Integrated Resource Assessment Data Collection

Students will collect field data needed for writing their Integrated Resource Assessment management plans. Field skills and ability to summarize and display data will be assessed. Students will develop appropriate sampling designs, collect needed field data with acceptable error limits, and summarize the data.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Major(s): Wildlife Ecology & Mgmt, Natural Resources Management, Wildlife Ecology & Cons, App Ecol & Environ Sci, Forestry
Pre-Requisite(s): FW 3190

FW 4815 - Wildlife Ecology and Conservation Capstone: Research

Students apply the scientific method to a wildlife research question including formulating hypotheses, providing predictions, and creating a study design. Students collect data, conduct statistical analyses, and draw conclusions based on their findings in research paper. Course integrates skills and knowledge from previous coursework.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of For Res & Env Sci; Must be enrolled in one of the following Major(s): Wildlife Ecology & Cons; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): FW 3190 and FW 3600

FW 4830 - Integrated Natural Resource Assessment

Course provides a capstone experience by integrating techniques from many of the forestry, applied ecology, wildlife ecology, and natural resources management core courses. Culminates in the development of management plans for various natural resource alternatives.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): FW 4811

FW 4835 - Wildlife Ecology and Conservation Capstone: Conservation

Students will develop a wildlife conservation plan for a defined planning area and target species. Includes review and synthesis of scientific research, policy, and social issues that inform or affect wildlife conservation planning.
Credits: 2.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following College(s): College of For Res & Env Sci; Must be enrolled in one of the following Major(s): Wildlife Ecology & Cons; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): FW 4815

FW 4840 - Senior Research Thesis

An independent study or research project on an approved topic in Forestry, Applied Ecology and Environmental Sciences, Wildlife Ecology, or Natural Resource Management, under the guidance of a faculty member. Available only to students in their graduating year.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): FW 3190

FW 4860 - Environmental Science and Sustainability Capstone

Provides a capstone experience by integrating knowledge and skills from the major core courses. Culminates in the development of a synthesis of literature and/or data related to an environmental science issue relevant to climate change, natural resource policy and geospatial sciences.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Environ Sci & Sustainability; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): FW 3020 and FW 3110 and FW 3540

Geological & Mining Engineering & Sciences

GE 1100 - Geological Engineering and Sciences Orientation

Introduction to geosciences as a profession, including discussions of career opportunities and geoscience programs. Earth materials and the earth's processes are also introduced. Includes frequent field trips. Intended for freshman or sophomore students in geological engineering, geology, applied geophysics, hydrology, geotechnics, earth science teaching, or any other geoscience program.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Geological Engineering, General Sciences and Arts, General Engineering, Mining Engineering, Applied Geophysics, Geology; May not be enrolled in one of the following Class(es): Junior, Senior

GE 1200 - Introduction to Data Science for Earth Resource Applications

Computational tools used in mining and geological engineering are introduced in earth resource contexts. Approaches for setting up, testing, and applying tools to solve practical problems are demonstrated and practiced.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): MA 1160(C) or MA 1161(C) or MA 1121(C)

GE 2000 - Understanding the Earth

Introduction to materials and processes that shape the earth we live on. Lecture and laboratories acquaint students with minerals, rocks, earth resources, weathering, geologic time, landslides, groundwater, streams, shorelines, deserts, glaciers, geologic structures, earthquakes, plate tectonics, and the dynamics of the earth's crust, mantle, and core.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall, Spring

GE 2010 - Introduction to Geographic Information Systems

This course covers basics in geospatial science from theoretical concepts, data, models, analytical techniques, to practical usage, and applications. Topics will include: fundamental concepts of cartography and mapping systems, characteristics and structure of GIS data, database construction, introduction to GIS data sources, principles and methods in spatial analysis, spatial interpolation, mapping of spatial and applications of GIS. Course will have lab using industry standard software tools.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): MA 1160 or MA 1161 or MA 1121

GE 2020 - Introduction to Mining Engineering and Mining Methods

Learn how various mining components, from prospecting to financing to reclamation, fit together. Includes advantages and drawbacks of different mining methods and their selection. Introduces ethics and professional development. Use of basic computer and mine design software.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall

GE 2100 - Environmental Geology

Introduction and study of current environmental issues related to the earth sciences. Covers major topics such as volcanism, earthquakes, shoreline erosion, and pollution of groundwater as multi-week modules with associated labs, lectures, and field projects.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

GE 2300 - Mineral Science

Chemical composition, crystal structure, physical properties, and identification of minerals. Environmental controls on their formation. Formation processes, characterization of and exploration of ore deposits. Laboratory focuses on hand specimen identification and introduction to X-ray diffraction and SEM mineral analysis techniques.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): CH 1000 or CH 1112 or (CH 1150 and CH 1151)

GE 2310 - Introduction to Petrology

Identification, physical properties, chemical composition, occurrence, and origin of the important types of igneous, sedimentary, and metamorphic rocks. Laboratory includes hand specimen description and identification of rocks.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Pre-Requisite(s): GE 2300

GE 2320 - Mining Methods and Systems

This course presents a study of the surface and underground mining methods practiced in coal, metal, and aggregate mine operations, classification of mining methods, support design and equipment selection, general mine planning requirements, mine development sequence, cycle of operations, and method application.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Pre-Requisite(s): GE 2020

GE 2640 - Atmospheric Observations and Meteorology

Introduction to fundamentals of atmospheric science and meteorology through direct observations of the atmosphere.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years

GE 3010 - Introduction to Field Methods

Introduction to geology field methods including maps, cross sections, navigation, GPS, field mineral and rock ID, and measurements of geologic features.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): GE 2300 and GE 2310 and GE 3050

GE 3040 - Fundamentals of Applied and Environmental Geophysics

An introduction to geophysical used in applied and environmental geophysics concentrating on the fundamentals of data reduction and interpretation. This course is not only pertinent for the practicing geoscientist but also for environmental engineers, civil engineers, and others interested in learning how physics can be used to investigate Earth's substance.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior
Pre-Requisite(s): PH 2200

GE 3050 - Structural Geology

Rock structures and regional settings resulting from the application of deforming forces, including the geometry, origin, and mechanics of folds, foliations, lineations, faults ad joints, and structures in orogenic belts.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): GE 2000

GE 3100 - Depositional Systems

Introduction to sedimentary processes and their products. Investigates the physical processes controlling sedimentation along with principles of correlation and interpretation of strata. Focuses on interpreting sedimentary rocks as a record of climate, sea-level and tectonic change.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): GE 2000 and GE 2310

GE 3200 - Geochemistry

Introduction to elements of modern geochemistry including aqueous solutions, isotopes, age dating, etc. Emphasizes concepts and quantitative methods. Teaches principles of thermodynamics and phase equilibria from an introductory perspective as they pertain to geologic systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): CH 1150 and CH 1151

GE 3250 - Computational Geosciences

Introduction to quantitative analysis and display of geologic data using R/Matlab, covering basic R/Matlab syntax and programming, and analysis of one-dimensional (e.g. time series) and two-dimensional datasets (i.e. spatial data). Techniques are applied to geological datasets.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MA 1160 or MA 1161 or MA 1121

GE 3320 - Earth History

This course covers the physical and biological history of the Earth from 4.5 billion years to the present. Emphasis on recognizing and evaluating the evidence for large-scale changes in major Earth Systems.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, in even years
Pre-Requisite(s): GE 2000 or GE 2100

GE 3440 - Drilling, Blasting, and Mine Safety Engineering

Rock penetration and fragmentation methods and boring, cutting, drilling, and blasting techniques. Design of surface and underground blasting rounds. Formulation of design criteria to minimize the adverse effects of blasting. Field demonstration in the design, monitoring, and evaluation of blasts. Principles of health/safety in mine practice.
Credits: 4.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): GE 2020 and PH 2100 and MA 2160

GE 3850 - Geohydrology

Geologic and hydrologic factors controlling the occurrence, movement, and development of subsurface water. Quantitative methods for analyzing groundwater systems are introduced.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Pre-Requisite(s): GE 2000 and MA 2160

GE 3870 - Resource & Reserve Estimation

This course covers the classification of resource and reserve; resource estimation algorithms; linear, nonlinear, and indicator kriging; stochastic simulation; variogram modeling; block-variance relationship; recoverable reserve; and introduction to resource estimation software.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Pre-Requisite(s): GE 2020 and MA 3710

GE 3880 - Mine Planning and Design

Course provides the basics of mine planning, feasibility study, block modeling, economic analysis, cost estimation and price forecasting, mining method selection algorithms. Introduction and hands-on experience with mine planning and design software including Surpac, Vulcan, and Whittle.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring
Pre-Requisite(s): GE 2320 and GE 3440 and GE 3870

GE 3890 - Engineering Geology and Rock Mechanics

Course will cover collection, analysis, and interpretation of geological data and information required for the safe development of civil works. Course will include laboratory experiments to determine the physical and mechanical properties of rocks, including hardness, tensile, and compressive strength.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall
Pre-Requisite(s): (GE 2000 or GE 2100) and (GE 3050 or ENG 2120 or MEEM 2150)

GE 4090 - Field Geophysics

Introduction to field geophysical techniques including basic land surveying. Emphasizes the recording, reduction, presentation, and interpretation of gravity, magnetic, electrical, seismic, and electromagnetic data as well as the proper use, care, and calibration of equipment used to collect the data. Requires report writing. Students must provide their own transportation.
Credits: 5.0
Lec-Rec-Lab: (0-0-15)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): GE 3040 and GE 3010

GE 4091 - Field Geology with Engineering Applications

Introduction to methods and problems of field geology, interpretation of field relationships, and engineering site investigation. Field areas are located in northern Michigan. Requires geological and/or engineering report and memo writing.
Credits: 5.0
Lec-Rec-Lab: (0-0-15)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): GE 2000 and GE 2310 and GE 3050 and GE 3010

GE 4115 - Environmental and Engineering Geophysics

Students will learn the geophysical methods including seismic (refraction, topography, and surface wave methods), ground penetrating radar (GPR), electromagnetic (EM), electrical resistivity, and gravity to address near surface environmental and geotechnical issues.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): GE 3040(C)

GE 4150 - Natural Hazards

This course focuses on current mitigation agencies and warning systems, case studies of successes and failures in hazard mitigation, and technical tools for hazard study and mitigation such as satellite remote sensing and GIS.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): GE 2000 or GE 2100

GE 4180 - Volcanology

Volcanoes and how they work. Volcanic eruption styles and products, their recognition, and significance. Volcanic hazards, volcano monitoring and impacts of volcanism on the environment, climate and society. Applies chemistry, physics, and fluid mechanics in a volcanological context.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): GE 2000 and (MA 1160 or MA 1161 or MA 1121)

GE 4190 - Magma Reservoir Dynamics

Introduction to topics in advanced igneous petrology emphasizing processes that occur in magma reservoirs. Includes the application and integration of geochemistry, petrology, and geochronology to investigate magma dynamics and their influence on frequency, style, and magnitude of eruptions.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): GE 2300 and GE 2310

GE 4220 - Mining Systems and The Environment

Develops the scientific basis for environmental management in ecosystems impacted by mining activities. Considers the origin, behavior, and fate of pollutants generated during the life of a mine. Introduces engineered approaches for mitigation, remediation and reclamation of environmental impacts.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1150

GE 4250 - Fundamentals of Remote Sensing

This course focuses on the basic physics behind above- surface remote sensing and remote sensing systems. Topics covered include: properties of the atmosphere, absorption and scattering of electromagnetic radiation, instrument design, data acquisition and processing, validation, and basic applications.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PH 2200 and MA 2160

GE 4290 - Mine Ventilation Engineering

Course deals with an introduction to mine ventilation, properties of air, gases, and dust, mine fans and its applications, flow distribution in mine network, computer analysis of ventilation network, mine health and safety overview, health and safety culture and practice.
Credits: 3.0
Lec-Rec-Lab: (0-0-9)
Semesters Offered: Spring
Pre-Requisite(s): GE 2020 and GE 2320 and (ENG 3200 or CEE 3200)

GE 4360 - Bulk Materials Dynamics & Engineering

Surface and underground materials handling methods. Selection and performance analysis of materials handling equipment. Computer applications.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 2100 and GE 2320 and ENG 2120

GE 4530 - Planetary Geology & Geophysics

Geological, geophysical, and geochemical processes in the Solar System are examined. Topics include the formation and evolution of the Solar System, planetary surface processes and water distribution, impact structures, composition, structure, and dynamics of planetary interiors, geophysical exploration of planets.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): GE 2000 and PH 2200 and MA 2160

GE 4560 - Earthquake Seismology

Course covers fundamentals of the physics of earthquakes and seismic energy propagation, and seismic methods to determine Earth structure. Emphasis is placed on natural source techniques, with extension to exploration applications. Weekly labs apply techniques.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): GE 3050 and PH 2100

GE 4600 - Reflection Seismology

Principles of reflection seismic techniques, including theoretical background and application, and hands-on computer projects. Included are acquisition, data processing, and 2D/3D data interpretation. Students conduct projects using actual commercial-quality seismic data.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Spring
Pre-Requisite(s): GE 3040

GE 4610 - Formation Evaluation and Petroleum Engineering

Principles and practice of formation evaluation, primarily through analysis of well logs and the principles and practice of petroleum engineering. Emphasizes reservoir engineering and simulation. Students conduct projects using actual field data.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall, Spring

GE 4680 - Reliability & Optimization in Mining

This course introduces the statistical analysis of mining data, statistical decision making of mining projects, random number generation, Monte Carlo methods, simulation methods, linear and integer programming, queueing theory, stochastic-process, PERT and CPM, applications of operations research (OR) in mining and mineral industry.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Spring, in even years
Pre-Requisite(s): GE 2020 or GE 2320

GE 4800 - Groundwater Engineering

Application of geohydrology principles to design water-well supplies, site investigations, and subsurface remediation systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Pre-Requisite(s): GE 3850 or CEE 3810

GE 4860 - Computational Methods in Geomechanics

Computer methods for the design problems encountered in encountered in geo-engineering projects. Applications to be selected from landslide stability analysis, slope stabilization and design, earth support systems, seepage, settlement, bearing capacity, and consolidation. Students will be introduced to limit equilibrium and finite element analysis.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): CEE 3810 or GE 3890

GE 4900 - Capstone I

Capstone engineering design course focusing on a realistic, complex, open-ended engineering problem. Project includes technical design, economic analysis, environmental impacts, and regulations. Report writing required. (Senior project ready as defined by major substitutes for prerequisites).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

GE 4910 - Capstone II

Capstone engineering design course focusing on a realistic, complex, open-ended engineering problem. Project includes technical design, economic analysis, environmental impacts, and regulations. Report writing required. (Senior project ready as defined by major substitutes for prerequisites).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): GE 4900

GE 4930 - Special Topics in Geological Engineering

Study and discussion of geological engineering topics.
Credits: variable to 5.0; Repeatable to a Max of 10
Semesters Offered: On Demand
Restrictions: Permission of instructor required

GE 4931 - Special Topics in Geology

Study and discussion of geology topics.
Credits: variable to 5.0; Repeatable to a Max of 10
Semesters Offered: On Demand
Restrictions: Permission of instructor required

GE 4933 - Special Topics in Geophysics

Study and discussion of geophysics topics.
Credits: variable to 5.0; Repeatable to a Max of 10
Semesters Offered: On Demand
Restrictions: Permission of instructor required

GE 4934 - Special Topics in Mining Engineering

Study and discussion of topics in mining engineering not included in regular undergraduate courses.
Credits: variable to 5.0; Repeatable to a Max of 10
Semesters Offered: On Demand

GE 4961 - Independent Geology Research Project

Approved literature, laboratory, and/or field geology research problem originated by the student or assigned by the instructor. A final report is required.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4962 - Independent Geophysics Research Project

Approved literature, laboratory, and/or field geophysics research problem originated by the student or assigned by the instructor. A final report is required.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

Human Factors

HF 1999 - Introduction to the Human Factors Major

Human Factors majors examine the field of human factors and major degree requirements resulting in an undergraduate plan of study focused on graduate school admission or career preparation. Students will be introduced to department research and other opportunities.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Human Factors

HF 2000 - Introduction to Engineering Psychology

This class will examine the capabilities and limitations of human perception and cognition and the application of theories and principles of human performance to the design.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

HF 3850 - Human Factors

This class will focus on when, why, and how to apply the various human factors methods for creating more effective human-technological systems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (PSY 2000 or HF 2000) and UN 1015

HF 3999 - Human Factors Third Year Seminar

A practical, task-based course to help you synthesize your post-bachelor's degree plans and goals. Involves work on applying to an advanced educational program or conducting a job search.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Human Factors; May not be enrolled in one of the following Class(es): Freshman, Sophomore

HF 4015 - Cognitive Task Analysis

Introduction to this cognitive-systems engineering method that unpacks complex work through systematic interviews with experts. Students will collect data to address engineering, business, or socio-technical challenges.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (PSY 2000 or HF 2000) and UN 1015

HF 4870 - Human-Centered Design

This course will focus on the human-system (computers, appliances, mobile devices, etc.) Interaction regarding the design and development of products. Students will experience hands-on HCI activities (analysis design evaluation) and practice research methods based on HCI theory and perspectives.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

HF 4880 - Usability Assessment

Explore the concept of usability and how this is assessed and applied to various products, interfaces, systems, and information with a focus on heuristic evaluation, cognitive walkthroughs, card sorting, tree testing, surveys, interviews, and ISO standards.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HF 4999 - Fourth Year Seminar: Culminating Experience Reflection

Students will reflect upon their experiences within a multidisciplinary team project and prepare a digital portfolio to showcase their preparation for the profession.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Human Factors; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): ENT 4900(C)

Pavlis Honors

HON 1150 - Launch Your Journey

Act with purpose! Explore community service, career preparation, and navigate university life using frameworks. Learn networking strategies, self-care, and adulting skills. Engage with guest panelists, use design thinking, and integrate service learning while crafting your personal story and future path.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required; Must be enrolled in one of the following Class(es): Freshman, Sophomore

HON 2150 - Know Yourself

Discover self-awareness and embrace ambiguity while deepening learning and welcoming challenges. Develop public profiles, negotiate effectively, and create connections. Engage in mindfulness, MBTI, emotional intelligence and design thinking. Explore values, identity, and conflict resolution.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HON 1150

HON 2500 - Entering Research I

This course introduces students new to research to best practices and skills related to university-level research and scholarship. Topics include developing a mentoring relationship, engaging with scholarly literature, documenting research, and ensuring research integrity in proposals and in communication findings.
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: On Demand

HON 2990 - Interdisciplinary Special Topics in Honors

This lower-level course focuses on the interdisciplinary special topic specified by its section title.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required

HON 3060 - Honors Practicum

This course is a reflective practicum for students fulfilling the immersion or project experience through a Pavlis Honors College Experiential Learning Community.
Credits: variable to 12.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): HON 2150

HON 3150 - Pavlis Seminar II

The second of three Pavlis Honors Pathway seminars, this course focuses on "telling your story" in different settings. The Honors Abilities of communicating empathetically and balancing confidence and humility are addressed.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): HON 2150

HON 3300 - Innovation through Human-Centered Design

This course introduces students to the processes and tools associated with human-centered design (HCD). HCS is a key process used in identifying needs/opportunities and innovative solutions.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

HON 3350 - Navigate Your World

Value diverse perspectives and engage in mentorship. Develop empathetic communication, self-authorship, and goal-setting skills. Explore leadership, governance, and ethical decision-making. Participate in alumni roundtables and delve into social justice, civic action, and difficult dialogues.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HON 2150

HON 3990 - Interdisciplinary Special Topics in Honors

This course focuses on the interdisciplinary special topic specified by its section title.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required

HON 4070 - Leadership Practicum

This course is designed for the Leadership Minor. It allows for non-international leadership experience and practical application of leadership knowledge, skills and behaviors. The practicum experience will be designed and implemented by the student, with guidance from the instructor.
Credits: variable to 9.0
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MGT 3100 or AF 3001

HON 4150 - Pavlis Seminar III

In this final Pavlis Honors Pathway seminar, students use a self-authorship framework to develop their own voice while engaging with other perspectives through learning partnerships. Difficult dialogues, decision making, critical thinking, and the synthesis and sharing of experiences are expected.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): HON 3150

HON 4250 - Experiential Learning in Cross-Cultural Immersions

This course allows student having combined classroom training and at least 50 hours of field experience with cross-cultural and community partners to reflect on connections and puzzles between personal experience and scholarly writing on social change, culture, and social problems.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

HON 4300 - Introduction to the Fundamentals of Social Innovation and Social Entrepreneurship

In this course, students will be exposed to key concepts and practices around social innovation and entrepreneurship. They will learn different approaches to social entrepreneurship, and the strengths and weaknesses of various models and strategies.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

HON 4350 - Tell Your Story

Develop and share stories from your journey by balancing confidence and humility. Explore storytelling through personal essays and professional statements. Create stories in various formats, written and oral. Craft a portfolio to launch your post-college journey
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): HON 3350

HON 4990 - Interdisciplinary Special Topics in Honors

This upper-level course focuses on the interdisciplinary special topic specified by its section title.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required

Humanities

HU 1000 - Introduction to Humanities

Introduces SEN, STA, STC, and SCCM majors to: the relevance of humanistic study to personal, professional, and civic life and the variety of critical and creative approaches to humanistic studies. Involves exploration of academic and career goals in Humanities related fields.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Scientific & Tech Comm (BS), Scientific & Tech Comm (BA), Communication, Culture & Media, English

HU 2130 - Introduction to Rhetoric

Focuses on historical origins, cultural adaptations, and contemporary relevance of rhetorical traditions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

HU 2200 - Introduction to World Cultures through Narrative and Film

Introduction to the study of global Hispanic, Francophone, and Germanic cultures as expressed in film, literature, and language. Emphasis on cultural awareness and understanding of cultural differences. Taught in English.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 2201 - Level I-A Chinese Language and Culture

Introduction to basic Chinese grammar, vocabulary, and idiomatic expressions, designed to help students acquire the basics of oral and written Chinese. Includes study of contemporary Chinese culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Senior

HU 2202 - Level I-B Chinese Language and Culture

Further study of Chinese grammar, vocabulary, and idioms with emphasis on conversation and communicative strategies. Includes continued study of Chinese culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2201 or Language Placement Chinese >= 100

HU 2241 - Level I-A Less Commonly Taught Languages

Introduction to basic grammar, vocabulary, and idioms, designed to help students acquire the basics of oral and written communication. Includes study of cultures in which the language is spoken.
Credits: variable to 3.0
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Senior

HU 2242 - Level I-B Less Commonly Taught Languages

Further study of grammar, vocabulary, and idioms with emphasis on conversation and communicative strategies. Includes continued study of cultures in which the language is spoken.
Credits: variable to 3.0
Semesters Offered: On Demand
Pre-Requisite(s): HU 2241

HU 2271 - Level I-A French Language and Culture

Introduction to basic French grammar, vocabulary, and idioms designed to help students acquire the basics of oral and written French. Includes study of contemporary French-speaking cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 2272 - Level I-B French Language and Culture

Further study of French grammar, vocabulary, and idioms with continued practice of conversation and basic readings in French. Continued study of contemporary French speaking cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2271 or Language Placement French >= 131

HU 2273 - Transitional Level I French Language and Culture

Intensive study of basic French grammar, vocabulary, and culture. Designed to prepare students with minimum essentials of oral and written French for intermediate and advanced level work. Students completing this course may apply for placement credits.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): Language Placement French >= 211

HU 2281 - Level I-A German Language and Culture

Introduction to the basics of the German language, acquainting students with the essentials of oral and written German and introducing cultures and societies of contemporary German-speaking Europe.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Senior

HU 2282 - Level I-B German Language and Culture

Further study of the basics of the German language acquainting students with the essentials of oral and written German, with emphasis on conversational skills. Includes continued discussion of cultures and societies of contemporary German-speaking Europe.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2281 or Language Placement German >= 201

HU 2291 - Level I-A Spanish Language and Culture

Introduction to basic Spanish grammar, vocabulary, and idioms, designed to help students acquire the basics of oral and written Spanish. Includes study of contemporary Spanish-speaking cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Senior

HU 2292 - Level I-B Spanish Language and Culture

Further study of basic Spanish grammar, vocabulary, and idioms with continued practice of conversation and basic readings in Spanish. Continued study of selected Hispanic cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2291 or Language Placement Spanish >= 131

HU 2293 - Transitional Level I Spanish Language and Culture

Intensive review of basic Spanish grammar, vocabulary, and culture. Designed to prepare students with minimum essentials of oral and written Spanish for intermediate and advanced level work. Students completing this course may apply for placement credit.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2291 or Language Placement Spanish >= 201

HU 2324 - Introduction to Film

Focuses on critical engagement with cinematic form and its relationship to cultural, historical, and/or theoretical contexts.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall, Summer

HU 2400 - Conversations on Culture and Diversity

This course provides students with a better understanding of underrepresented populations within the United States by examining the social, cultural, and personal consequences of gender, race, ethnicity, class, sexual orientation, (dis)ability, and other significant identities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 2500 - Writing About Literature

This course introduces students to reading strategies, critical vocabularies, and critical writing practices. Individual sections will center on a unifying question or problem, emphasizing attentive reading, critical thinking, and qualitative interpretation of literary texts.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015

HU 2501 - American Experience in Literature

A survey of major works in American Literature from origins to the present. Focuses on historical trends in the development of literature and culture in the Americas with particular emphasis on the United States.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years

HU 2503 - Introduction to Literature

Survey of transnational or transatlantic literary traditions, highlighting select historical periods such as Romanticism, and/or movements, such as the Harlem Renaissance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

HU 2505 - Humanities, Science, and Technology

Uses approaches from humanities disciplines to contextualize and examine scientific and technological developments as well as representations of science and technology. May include the study of literary texts, narrative history, documentary evidence, film, music, popular culture, and cross-cultural references.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 2510 - Intro to Creative Writing

An introduction to creative writing with readings in contemporary and emerging literatures. Genres covered may include fiction, nonfiction, poetry, and screenplay. This course stresses individual production through process-oriented writing exercises, small group workshops, individual conferences, and creative theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): UN 1015

HU 2538 - British Experience in Literature

A survey of selected works of British literature from its origins to the present. Focuses on historical trends in the development of the English language and the cultures of Great Britain.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years, Spring, in even years

HU 2548 - Young Adult Literature

Reading, reflecting on, and responding to age-appropriate adolescent literature. Works include authors from different races, cultures, historical periods, and genders. Discussion may be supplemented with films. Appropriate for students who plan to be parents, community volunteers, and teachers.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 2600 - Introduction to Writing in Science and Technology

An introduction to the professional practice of scientific and technical writing. Includes the organization, style, and mechanics of technical writing, and practice in writing common technical and scientific documents including descriptions, instructions, proposals, and recommendations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 2633 - Fundamentals of Digital Imaging

Explores the history, aesthetic, theory, and practice of digital imaging. Students learn to find, make, and analyze images.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring

HU 2642 - Introduction to Digital Media

Basic principles, practices and implications of digital media communication and production. Provides foundation in tools, techniques and processes through hands-on production, readings, discussion and analysis of contemporary issues related to digital media.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 2645 - Graphic and Information Design

A computer-intensive introduction to the principles for creating clear, effective graphic communication. Students critique the work of other designers in terms of the work's audience and intended effect, and they construct and critique their own design projects as well.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer

HU 2646 - Writing with Web Technologies

Theories and techniques of content creation for the web, including rhetorical considerations, plain language guidelines, accessibility standards, and the use of markup, style sheets, scripting, and content management systems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015(C)

HU 2700 - Introduction to Philosophy

A study of thought representing various traditions such as classical and contemporary philosophy, Eastern and Western religion, and issues in recent science. Some basic concepts of logic are also examined. Emphasizes moral philosophy, including ethical relativism, utilitarianism, and Kantian ethics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer

HU 2701 - Logic and Critical Thinking

Introduction to everyday reasoning and formal logic. Important goal is to develop skills of argument identification, analysis, and evaluation. Students learn how to symbolize ordinary language statements and arguments and to determine their validity or invalidity using proof and truth-table methods.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 2702 - Ethical Theory and Moral Problems

An introduction to the major concepts and theories of normative ethics and metaethics and an examination of a variety of issues in applied ethics including poverty and economic justice, lying and truth-telling, euthanasia, sexual conduct, and issues in communication ethics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 2810 - Research and Writing in Communication

Prepare students to evaluate, design, and conduct research in communication. Develops research-related writing strategies and proficiency.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): UN 1015

HU 2820 - Communication and Culture

Introduction to the ways that communication creates and maintains culture. Considers a variety of perspectives on the significance of communication. Explores the importance of communication for understanding culture
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

HU 2825 - Technology and Media

A survey of theories and perspectives that consider the interrelationship between technology and media and their influence in society. Issues may include infrastructure, diffusion, globalization, aesthetics, ethics, culture, conveyance, and change.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

HU 2830 - Public Speaking & Multimedia

Introduces the fundamentals of public speaking and multimedia applications. Emphasis on speaking/listening competencies in face-to-face and digital environments using online and digital tools.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): UN 1015

HU 2840 - Interpersonal Communication and Technology

Examines practices and issues of relational communication and encourages critical awareness of common assumptions. Topics include computer-mediated communication, communicating with machine verbal and nonverbal cues, conflict models, friendship, intimacy, and the interpersonal significance of race, gender, class, and disability.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 2910 - Language and Mind

Linguistic study of structural and cognitive aspects of language. Examines language design: how sounds, words, sentences, and conversation create meaning; the relationship of language, brain, mind, and thought; the ability of humans, animals, and machines to acquire language.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 2920 - Language and Society

Examines how societies use and organize themselves with respect to language. Considers attitudes towards language standardization and dialectal variations within the US based on geography, class, ethnicity, gender, age, etc., and speakers' choices of how they present themselves linguistically.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 3000 - Humanities Experience: Community-Engaged Learning

Combines project-based learning with active community engagement. Students will explore key themes and methods within the humanities and apply their knowledge through a hands-on project in collaboration with campus, community, or global partners. Projects will vary.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3015 - Advanced Composition

Advanced instruction in composing substantive arguments based on primary and secondary research. Multidisciplinary inquiry-based projects ask students to write for both academic and lay audiences in print and digital forms. Specific research methods, writing technologies, and topics vary by section.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): UN 1015

HU 3105 - Writing About Numbers

Teaches expository writing techniques for using quantitative information as evidence. Focuses on rhetorical strategies for considering contexts, purposes, and audiences needed to support arguments with numerical data. Includes practice representing numbers in prose, information graphics, and presentations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3120 - Technical and Professional Communication

A study of written and oral communication in technical and scientific environments; emphasizes audience, writing processes, genres of scientific and technical discourse, visual communication, collaboration, professional responsibility, clear and correct expression. Students write and revise several documents and give oral report(s).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman

HU 3121 - Advanced Technical Writing

Builds on technical writing fundamentals, focusing on structured authoring techniques for writing complex technical product/process documents for multiple delivery formats.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015 and (HU 2600 or HU 3120)

HU 3130 - Rhetoric of Science and Technology

A study of contemporary theories of rhetoric and their application to interpreting and critiquing various forms of persuasive discourse, especially in science and technology.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015

HU 3135 - Power and Bias in Technology Design

Examines technology as a tool of oppression or liberation with regards to identity categories and differences in ability, ethnicity, race, age, class, gender, and sexuality. Explores design methodologies focused on values of equity and justice.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3140 - Rhetoric of Health & Medicine

A study of contemporary theories of rhetoric and their application to interpreting and critiquing various forms of persuasive discourse, especially in health and medicine.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3150 - Topics in Literacy Studies

A study of how and why different groups of people use reading and writing differently in varying situations and in varying textual media. Topics may include the various ways texts function and reading is used; the authority of written texts; access to reading and writing and to various textual media.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3151 - The Rhetoric of Everyday Texts

The examination and production of everyday texts such as social media, image-texts, web pages, signs, museum exhibits, architecture, and fashion in terms of their theoretical, historical, cultural, and technological contexts.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

HU 3160 - The Rhetoric and Culture of Games

The examination and design of multimodal "games" such as tabletop games, digital games, and board games, focusing on their cultural, rhetorical, and ethical dimensions. While no prior game design experience is required, students should expect to produce their own games, as well as write about games examined in the course.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

HU 3201 - Level II-A Chinese Language and Culture

Review and continued study of listening, speaking, reading, and writing in Chinese. Students learn how to communicate in Chinese societies. Includes study of various aspects of the Chinese culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2202 or Language Placement Chinese >= 201

HU 3202 - Level II-B Chinese Language and Culture

Further study of Chinese language. Includes study of vocabulary, idioms, and sentences structure to improve conversational, reading, and writing abilities. Includes discussion of various aspects of Chinese culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3201 or Language Placement Chinese >= 301

HU 3204 - Level III Topics in Chinese Literature and Culture

Study of various genres of Chinese literature and of various aspects of Chinese society, emphasizing, historical and cultural backgrounds. Conducted primarily in Chinese.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3202 or Language Placement Chinese >= 401

HU 3241 - Level II A Less Commonly Taught Language and Culture

Review and continued study of listening, speaking, reading, and writing in less commonly taught language. Students learn how to communicate in target culture. Includes study of various aspects of the culture in which the language is used.
Credits: variable to 3.0
Semesters Offered: On Demand
Pre-Requisite(s): HU 2242

HU 3242 - Level II B Less Commonly Taught Language and Culture

Further study of less commonly taught language. Includes study of vocabulary, idioms, and sentence structure to improve conversational reading and writing abilities and discussions of various aspects of culture in which the language is used.
Credits: variable to 3.0
Semesters Offered: On Demand
Pre-Requisite(s): HU 3241

HU 3253 - World Literatures & Cultures

Comparative approach to world literatures and cultures. May include literary works, critical essays, films, music, and other representations of world culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3261 - Topics in Communicating Across Cultures

Examines communication practices and styles across selected cultures and multicultural groups, drawing on an interdisciplinary range of research fields. May address social issues, language and cultural differences, gender, race, ethnicity, class, disabilities, age, religion, family and national identity.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3262 - Topics in Francophone Cultures

An introduction to Francophone cultures (in English) in a comparative perspective. Includes a survey of French history and its influence on Francophone societies. Includes study of film and other media and a critical examination of cross-cultural differences between French, Francophone, and U.S. cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3263 - Topics in German-Speaking Cultures

An introduction to German-speaking culture (in English) in a comparative perspective. Includes a survey of Central-European history and its influence on modern-day German-speaking societies through movies, media, and recent technologies, and a critical examination of cross-cultural differences between German and North-American cultures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): UN 1015

HU 3264 - Topics in Spanish-Speaking Cultures

An introduction to Spanish-speaking cultures (in English) in comparative historical perspectives. Includes a survey and a critical cross-cultural examination of Latin-American cultures and Spanish-speaking societies (European, Caribbean, and North, Central and South American) through literature, music, film, art, and other media.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): UN 1015

HU 3265 - Topics in East Asian Cultures

Introduction to the contemporary and traditional cultures of China, Korea, and Japan taught through readings, films, lectures, and discussions. Taught in English.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

HU 3269 - International Language Study in Spanish, German, or French

International study in Spanish, German, or French. Taught in the target language. Used for study abroad only.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand

HU 3271 - Level II-A French Language and Culture

Review and continued study of grammar, vocabulary, speaking, listening, reading, and writing in French. Includes written compositions and oral presentations. Cultural focus on several Francophone regions of the world.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2272 or HU 2273 or Language Placement French >= 331

HU 3272 - Level II-B French Language and Culture

Continued study of grammar, vocabulary, speaking, listening, reading, and writing in French. Includes written compositions, oral presentations, and reading of brief literary texts. Cultural focus on several Francophone regions of the world.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3271 or Language Placement French >= 421

HU 3273 - Level II-C French Composition and Conversation

Extensive work in the active, creative use of written and oral French. Includes development of communicative strategies, written compositions, and oral presentations in the context of contemporary French-speaking cultures. May include study of film and other media.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3272 or Language Placement French >= 501

HU 3274 - Level III Topics in French Literature and Culture

Topics in French literature and its historical and cultural contexts. May include selections from Francophone literature. Conducted in French.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand, in odd years
Pre-Requisite(s): HU 3272 or HU 3273 or Language Placement French >= 501 or CEEB French Language >= 3 or CEEB French Literature >= 3

HU 3275 - Level III French for Special Purposes

Study of business, technical, and/or scientific discourses in the context of French language and Francophone cultures.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand, in odd years
Pre-Requisite(s): HU 3272 or HU 3273 or Language Placement French >= 501 or CEEB French Language >= 3 or CEEB French Literature >= 3

HU 3281 - Level II-A German Language and Culture

Concluding study and review of the basics of the German language. Includes study of vocabulary, idioms, and sentence structure to improve conversational and reading abilities, and discussion of various aspects of contemporary German culture.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2282 or Language Placement German >= 321

HU 3282 - Level II-B German Language and Culture

Review of the basics of the German language. Includes study of vocabulary, idioms, and sentence structure to improve conversational and reading abilities, and writing of compositions in German.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 3281 or Language Placement German >= 441

HU 3283 - German Composition and Conversation

Review of the basics of the German language. Includes study of vocabulary, idioms, and sentence structure to improve conversational and reading abilities and writing of compositions in German.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): (HU 3282 or Language Placement German >= 561) and UN 1015

HU 3284 - Level III in German Literature and Culture

Study of German literature and cultures. Topics may include postwar German literature, Germany since WWII, or emphasis on a major contemporary writer. Readings, discussion and writing in German.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 3282 or HU 3283 or Language Placement German >= 561 or CEEB German Language >= 3

HU 3285 - Level III German: Film and Media

Study of German film, news and media. Topics may include feature films, documentaries, and other audio-visual and digital texts. Readings, discussion, and writing in German.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): HU 3282 or HU 3283 or Language Placement German >= 561 or CEEB German Language >= 3

HU 3286 - Level III German Special Topics

Advanced German language study. Topics may include advanced grammar, translation, or German for specific contexts such as engineering and other sciences, healthcare, business, or legal professions. Readings, discussion, and writing in German.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3282 or HU 3283 or Language Placement German >= 561 or CEEB German Language >= 3

HU 3289 - Experiential Humanities: Exploring Topics in German Speaking Communities

Investigate topics in German-speaking cultures while sustainably exploring landscapes and cities abroad. Examine the relationship between history and current events. Consider the evolving role of the individual in society within shifting borders and competing ideologies,
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Summer
Restrictions: Permission of department required
Pre-Requisite(s): UN 1015

HU 3291 - Level II Spanish Language and Culture

Review and continued study of grammar, vocabulary, speaking, listening, reading, and writing in Spanish. Includes written compositions and oral presentations. Cultural focus on several Spanish-speaking regions. Students completing this course may apply for placement credit.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 2292 or HU 2293 or Language Placement Spanish >= 321

HU 3292 - Level II-B Spanish Language and Culture

Continued study of grammar, vocabulary, speaking, listening, reading, and writing in Spanish. Includes written compositions, oral presentations, and readings of short literary and documentary texts. Strong cultural focus on several Spanish-speaking regions. Students completing this course may apply for placement credit.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 3291 or Language Placement Spanish >= 401

HU 3293 - Level IIC Spanish Composition and Conversation

Advanced grammar, composition, and conversation practice. Readings may include texts from literary, social, economic, scientific, engineering, or business discourses in the context of Hispanic cultures. Students completing this course may apply for placement credit.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): HU 3292 or Language Placement Spanish >= 480 or CEEB Spanish Language >= 3 or CEEB Spanish Literature >= 3

HU 3294 - Topics in Hispanic Literatures and Cultures

Study of selected works of literature, culture, and civilization from selected regions of the Spanish-speaking world. May incorporate study of literary genres and historical periods as related to Spain and/or Latin American cultures. Students completing this course may apply for placement credits.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3293 or Language Placement Spanish >= 631 or CEEB Spanish Language >= 4 or CEEB Spanish Literature >= 4

HU 3295 - Level III Advanced Spanish for Literacies

Spanish for Special Purposes is designed for students who anticipate careers in which they will need to interact with Hispanic communities in the U.S. or abroad and who wish to continue study of Spanish language and culture for specific professional purposes. Topics include Spanish for engineering and other sciences, healthcare, business, and legal professions.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years, Spring, in odd years
Pre-Requisite(s): HU 3293 or Language Placement Spanish >= 631 or CEEB Spanish Language >= 4 or CEEB Spanish Literature >= 4

HU 3296 - Survey of Hispanic Literatures and Cultures

Overview of Iberian and/or Latin American literatures and cultures from colonial through contemporary periods, including the arts and popular movements, from a multidisciplinary perspective. Course is repeatable up to six credits.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): HU 3293 or Language Placement Spanish >= 631 or CEEB Spanish Language >= 4 or CEEB Spanish Literature >= 4

HU 3298 - Experience Spanish Language & Culture through Teaching

Spanish teaching by applying theories in second language acquisition at local schools with instructor's guidance. Reflect on owns personal culture, experience of teaching and acquiring languages, showcase growth in communication, cultural awareness, critical thinking, and intercultural competence.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): HU 3292 or Language Placement Spanish >= 480

HU 3299 - Exploring a Hispanic City by Analyzing its Film Production

Explore films linked by the common thread of the city we are visiting as a character. Discuss them through referential spaces of the city and break the division between the setting of the film and its fiction. Compare and reflect upon local history and its representation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Summer
Pre-Requisite(s): UN 1015

HU 3326 - Topics in World Cinema

This course focuses on mainstream and/or independent films in their historical and sociocultural contexts from selected regions such as Latin America, Africa, the Middle East, Asia, and Europe.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years, Spring, in odd years
Pre-Requisite(s): UN 1015

HU 3327 - Film Style and Genre

Focus on film style and genre with an emphasis on study of directors, movements, and aesthetics and their technological, theoretical, and socio-cultural contexts. Includes small lab projects.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

HU 3370 - The Documentary Experience

Focuses on the craft and ethics of documentary storytelling from the perspective of filmmakers, participants, and audiences. Through hands-on projects, documentary analysis, film festival attendance, and critical reflection. Students will examine key questions, and techniques that inform documentary practice and reception.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall

HU 3400 - Topics in Diversity Studies

This course provides students with a better understanding of underrepresented populations within the United States by examining the culture and experience of African American; American Indian; Asian American; Latina/Latino American; Gay, Lesbian, Bisexual, and Transsexual; or Post-Colonial peoples.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

HU 3401 - Gender and Culture

Interrelations of gender and culture, including comparative analysis of constructions of gender. May examine different societies and/or different historical periods.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3502 - Mythology

Survey of the major mythological systems of the world with particular attention to those areas of commonality among various civilizations. Films may provide contextual background.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer, in odd years
Pre-Requisite(s): UN 1015

HU 3503 - Special Topics: Literature and Culture

Examines an important theme of topic in the Humanities, such as theory, language, literature and culture. May be repeated for up to nine credits if topic differs.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3504 - Studies in the Novel

Examination of the novel in world literature with special attention to the historical, cultural, and personal contexts within which the author is writing. Film versions may be examined.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3505 - Special Topics Literary Forms

This course examines one or more literary forms, genres, and modes such as tragedy, satire, romance, science fiction, fantasy, comedy, epics, novels, short stories, poetry, and/or creative nonfiction.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3506 - Major Authors

An intensive study of the life and works of one or more significant literary figures. This course will also focus on the social and historical contexts that shaped the author's reputation and standing in the literary, theatrical, or cinematic canon.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3507 - Cultural Traditions in Literature

An advanced study of a specific transnational or trans-Atlantic historical period or aesthetic movement that illustrates the development of literary and/or cinematic traditions. Courses will include relevant theory and criticism.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3508 - Literature and the Environment

In this course students examine the interdisciplinary relationship between literature and environmental and ecological studies. Topics to be explored include eco-criticism, eco-feminism, environmental (in) justice, indigeneity, sustainability, and animal studies.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): UN 1015

HU 3509 - Studies in Drama

Examines post-Shakespearean drama and the cultural history of theatre. Courses will focus on a selection of plays each semester, and address a range of topics, including theatre history and performance theory.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3513 - Shakespeare

In-depth study of a limited number of Shakespearean plays with special attention to dramatic structure, character development, theme presentation, and theatre history. Includes extensive study of Renaissance influences, possibly film versions of selected plays, and examination of current critical theories.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015

HU 3514 - Workshop in Creative Nonfiction

Advanced work in creative nonfiction writing; workshop format. Readings will include short memoirs, personal essays, lyric essays, and other sub-genres of contemporary creative nonfiction. Emphasis on individual production through process-oriented writing exercises, small group workshops, individual conferences, and revision/development.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2510 and UN 1015

HU 3515 - Workshop in Poetry

Advanced work in poetry writing; workshop format. Students will study contemporary and emerging works in order to enrich and stimulate their own poetic practice. Emphasis on individual production through process oriented writing exercises, small group workshops, individual conferences, and revision/development.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2510 and UN 1015

HU 3516 - Workshop in Fiction

Advanced work in fiction writing; workshop format. Readings will include 'canonical', contemporary, and emerging examples of short-form fiction. Emphasis on individual production through process-oriented writing exercises, small group workshops, individual conferences, and revision/development.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2510 and UN 1015

HU 3517 - Literary Theory and Criticism

A consideration of a variety of theoretical and critical approaches and methods of literary research in the study of British and American literature.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): UN 1015

HU 3518 - Workshop in Science Fiction Writing

This course focuses on the craft of writing science fiction. Reading stories from classic to contemporary sci-fi and examining key features of the genre. Writing assignments will include reading responses, short creative exercises, peer review, and a research-driven work of fiction.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years, Spring, in even years
Pre-Requisite(s): UN 1015

HU 3519 - Workshop in Nature Writing

This course focuses on the craft of environmental and nature writing. In conjunction with creative writing exercise and peer review, students will analyze a variety of exemplary texts within the genre, culminating in the production of a research-driven manuscript in either poetry, fiction, or nonfiction.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): UN 1015

HU 3545 - Literature Across Borders

Study of literary genres, themes, and movements, with emphasis on comparing and contrasting perspectives reflected in literatures from Western and non-Western cultures. Topics may focus on historical, social, aesthetic, and cultural factors as they influence these literatures. Films may be used.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): UN 1015

HU 3554 - Science Fiction

Close study of significant works in science fiction and fantasy. Examines genre features and usage and attends to a writer's style and methods. Regularly focuses on historical fiction and fantasy using film to help establish literary context.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3557 - Literature and Science

Focuses on depictions of science in literature and literary features of scientific texts from a range of historical periods, genres, and nationalities. May include the influence of scientific methods on literature and vice versa (for instance, narrative medicine).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3600 - Professional Development in the Humanities

Addresses conventions and expectations for professional development through projects such as portfolio development and research into contemporary professional and workplace issues. Explores career and graduate school opportunities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Communication, Culture & Media, Scientific & Tech Comm (BS), English, Liberal Arts, Scientific & Tech Comm (BA), Humanities, Comm and Culture Studies; May not be enrolled in one of the following Class(es): Freshman

HU 3605 - Style, Grammar, & Power in Society and Culture

Description and analysis of current standards of grammar and usage in the U.S. Students acquire an understanding of the structures of American English as well as an understanding of the social forces underlying standardization and the processes of language change.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3606 - Editing

Examination of the responsibilities of an editor and grounding in basic editorial skills. Topics include situations of editing, levels of editing, readability, correctness, style, relations with authors, and social and political implications of editing.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3621 - HU Experience in Journalism

This course engages students in the theory and practice of community journalism through immersive participation in the MTU Lode alongside study of journalistic process and craft.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): UN 1015

HU 3630 - Publications and Information Management

Principles of information selection, editing, layout, and graphics essential to the scheduling, budgeting, and production of various print and digital publications.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2633 or HU 2645

HU 3692 - Writing for Scientific Audiences

Studies and practices principles for sharing scientific knowledge in professional settings. Focuses on: scientific papers, research proposals, and scientific posters, among other genres.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3693 - Science Writing for Public Audiences

Introduces writing, research, and editing that contribute to a public understanding of science.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3694 - Grant Writing

Introduces fundamentals of grant proposal writing and research. Possible topics: writing for nonprofits, grant writing in various disciplines, researching funding resources.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3695 - Digital Writing and Rhetoric

Examining and composing for digital media spaces, with special attention to the rhetorical effects and effectiveness of digital writing, as well as the historical, ethical, and social implications of digital platforms.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3698 - Writing for Health/Medical Audiences

Studies and practices principles for sharing scientific knowledge in meetings with other medical and health professionals.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3699 - Health/Medical Writing for Public Audiences

Introduces writing, research, and editing that contribute to a public understanding of health and medicine.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3700 - Philosophy of Science

Examination of problems involved in scientific methodology such as theory structure, concept formation, scientific explanation, hypothetico-deductive model, role of experimentation, function of paradigms and analogies, distinction between science and pseudoscience, extent to which science is value-free or value-laden, social responsibility of scientists, and aims of science.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3701 - Philosophy of Technology

A study of philosophical analyses of technology. Topics may include: the essence and nature of technology, technology and human existence; the notion that we live in a technological age; and ethical issues surrounding the use, abuse, and ubiquity of technology.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015

HU 3702 - Philosophy of Religion

An examination of some philosophical questions in diverse religious traditions including the existence of God, the problem of evil, and the nature of religious experience.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015

HU 3703 - HU Experience in Environmental Philosophy

This course explores different ways of reflecting on our relationships to our natural environments, inquiring into the meaning of environment, ecology, resources, and management. It analyzes the social and ethical dimensions; examining how different understandings of 'environment' affect policy, ethics, law, and technology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3704 - Ethics of Artificial Intelligence

An introduction to the philosophical issues raised by current and future AI systems with a special focus on ethical foundations and general normative concerns. Including AI prediction, classification, manipulation, surveillance; AI agency, responsibility moral status; the future of work; human rights; use of AI in governance, health, education, and more.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring

HU 3705 - Media and Communication Ethics

A study of ethical approaches to issues in media and communication. Issues may include bias, objectivity, and neutrality; conflicts of interest; advocacy; privacy; ethics photojournalism; diversity and representation; AI; use of data in health, science, and environmental journalism.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

HU 3710 - Engineering Ethics

A study of ethical questions confronting individual engineers and the engineering profession. Among the issues to be explored are the meaning of professionalism, the social responsibilities of engineers, engineer-employer and engineer-client relationships, whistle-blowing, conflicts of interest, and competitive bidding.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

HU 3711 - Biomedical Ethics

A study of several important ethical and philosophical issues that arise in medical practice and in biomedical science. Issues may include euthanasia, abortion, the physician-patient relationship, experimentation involving human subjects, and allocation of scarce biomedical resources. General ethical theories and concepts are used to shed light on those issues.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3800 - Media and Society

Examines contemporary forms of mediated communication. Emphasis on understanding media economics and impacts of media on attitudes, values, behavior, and identity. Topics may include propaganda, advertising, political communication, journalism, media violence, social media, surveillance, and media policy.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

HU 3802 - Media and Globalization

Examines the development of modern international communication systems, the rise of transnational media industries and technologies, and debates about their global impacts.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand, in odd years
Pre-Requisite(s): UN 1015

HU 3810 - HU Experience in Technology & Critical Making

Considers interrelationships between technology and culture. Includes understanding the context within which technologies are developed and used, and how assumptions about technology shape knowledge, practice, and creative action.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

HU 3825 - HU Experience in Environmental Communication

Critical and cultural approach to concepts, and controversies in environmental communication. Topics may include environmental journalism, rhetoric of sustainability, risk communication, politics of climate representation, consumerism, eco-tourism, public policy, environmental justice.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): UN 1015

HU 3830 - HU Experience in Creativity, Culture, and Change

Examines the sources of creativity and the ways that it has been used to change cultural values, feelings, beliefs, and practices. A project-based course that cultivates and applies creative action toward cultural change.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3832 - Virtual Encounters

Students will use digital delivery modes to design and deliver presentations for a variety of social and professional purposes. Students will explore the ethical, social, and political implications of digital delivery for civic life and public discourse.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3840 - Organizational Communication

An approach to understanding organizations in their socio-historical contexts from a variety of theoretical perspectives in communication. Explores meanings, roles, relations, interactions, and structures from a communication perspective.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3845 - Human-Machine Communication

Surveys the area of Human-Machine Communication. Considers a variety of communicative machines, contexts, and perspectives. Examines issues of agency, media representations, co-construction, culture, privacy, and other ideas in relation to the communicative interplay of humans and machines.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015

HU 3850 - Automated Culture: Critical Approaches to AI

Examines the way that culture communicates values, feelings, beliefs; structures differential relations of power and possibility; creates difference and hierarchy. Considers the struggles over meaning that open up possibilities for diversity and change.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3852 - See and Be Seen: Data, Surveillance & Society

Considers surveillance practices and the surveillance imaginary through media that take surveillance as their principal feature. Covers perspectives such as those of the watchers and the watched; kinds and purposes of surveillance; and the relationship between filmic surveillance and our sense and practices of freedom versus control.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015

HU 3855 - Power, Activism, and Technology

How social, cultural, and political power arrangements create the contexts of activism and the impact of technology on acts of resistance. We will foster critical thinking around notions of power, violence, discourse, technology, and the media environment.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand, in even years
Pre-Requisite(s): UN 1015

HU 3860 - Cultural Theory and Popular Culture

Introduces fundamentals of cultural theory and media criticism. Considers historical, social, political, and economic contexts of popular culture from a media studies perspective.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

HU 3871 - Media Theory

Examines relationships among changing communication technologies and communication theories. Emphasizes issues involving emerging technologies and emerging theory.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): UN 1015

HU 3872 - Machines in the Mist: Visuality and Culture

Engages with color as an aesthetic, theoretical, historical, cultural, and political concept. Explores media histories of visuality in black and white and in color in various expressive and interpretative contexts including politics, science, and industry.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): UN 1015

HU 3882 - Media Industries

Examines economic, political, and cultural aspects of media industries (cinema, broadcasting, music, gaming, telecommunications, and advertising) from historical and contemporary contexts.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3910 - Language and Globalization

Considers the historical rise of the English language and other dominant languages, and present effects on minority and endangered languages within the US and abroad; World Englishes and dialectal variation; and the interaction of forces of globalization/standardization with localization/identity.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 3940 - Language and Identity

Examines how individuals create and perform their social identities through and in response to language, considering social variables such as race, ethnicity, class, gender, sexuality, disability, geography, power, ideology, etc. Explores how these variables may intersect, clash, and be resolved.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 3950 - Sound and Culture

Immersion in techniques of listening to the soundscapes of daily life and identifying interrelationships between sound, culture, and one's perceptions of the world. Exploration of sound history, technologically produced and mediated sound, architectural and urban sound, and ecological soundscapes.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

HU 4041 - HU Experience in Communication for Sustainability

Starting from the United Nations sustainable development goals, explores community-level sustainability challenges, potential solutions, and communication strategies to promote awareness and project support. Focuses on concepts such as sustainability, community-driven project development, and application of communication strategies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 1015

HU 4050 - Special Topics

Tutorial, seminar, workshop, or class study of special interest and importance in the humanities. Students should register by section number for the appropriate instructor and topic.
Credits: variable to 6.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

HU 4060 - Humanities Workshop

Special workshop projects in the humanities such as tutorials, editing, Shakespeare Faire drama workshop, writer's workshop, or study-abroad tours. Approved credit varies by degree program.
Credits: variable to 6.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

HU 4101 - Writing Center Practicum

Study of writing center theory and practice, including pedagogical and tutoring techniques.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): UN 1015

HU 4102 - Lode Practicum for Student Journalists

Reflective practicum in which the theory and practice of journalism is applied as a student writer for the Michigan Tech Lode.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): UN 1015

HU 4271 - Modern Language Seminar I-French

Language and power. Critical study of the representation of politics, economics, and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in French and English translations. Course offered third year beginning 2009-2010.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3274 or HU 3275

HU 4272 - Modern Language Seminar II-French

Individual and society. Critical study of the relationship between the individual and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in French and in English translation. Course offered third year beginning 2010-2011.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3274 or HU 3275

HU 4273 - Modern Language Seminar III-French

Technology in literature and film. Critical study of the representation of modern technology in literature, film, and authentic documents from French, German and Hispanic language communities. Students read texts in French and in English translation. Course offered every third year beginning 2008-2009.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): (HU 3274 or HU 3275) and UN 1015

HU 4281 - Modern Language Seminar I-German

Language and power. Critical study of the representation of politics, economies, and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in German and in English translation. Course offered every third year beginning 2008-2009.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3284 or HU 3285

HU 4282 - Modern Language Seminar II-German

Individual and society. Critical study of the relationship between the individual and social institutions in literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in German and in English translation. Course offered every third year beginning 2009-2010.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): (HU 3284 or HU 3285) and UN 1015

HU 4283 - Modern Language Seminar III-German

Technology in literature and film. Critical study of the relationship between modern technology and literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in German and in English translation. Course offered every third year beginning 2010-2011.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3284 or HU 3285

HU 4291 - Level IV Modern Language Seminar I-Spanish

Language and power. Critical study of the representation of politics, economies, and social institutions in literature, film, and authentic texts in French, German, and Hispanic language communities. Students read texts in Spanish and English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3294 or HU 3295 or HU 3296

HU 4292 - Level IV Modern Language Seminar II-Spanish

Individual and society. Critical study of the relationship between the individual and social institutions in literature, film, and authentic documents from French, German and Hispanic speaking communities. Students read texts in Spanish and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3294 or HU 3295 or HU 3296

HU 4293 - Level IV Modern Language Seminar III-Spanish

Technology in literature and film. Critical study of the relationship between modern technology and literature, film, and authentic documents from French, German, and Hispanic language communities. Students read texts in Spanish and in English translation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): HU 3294 or HU 3295 or HU 3296

HU 4327 - Multimedia Storytelling

Production-intensive focus on how media producers use audio, video, and digital platforms to tell a story, realize a creative vision, and engage an audience.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2324

HU 4370 - Documentary Workshop

Advanced work in documentary production and storytelling. Students will research, develop, and produce documentary films, with an emphasis on visual storytelling, sound design, and narrative, as well as documentary process and ethics. Study of history and theory of documentary sub-genres.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring, in even years
Pre-Requisite(s): HU 2633 or HU 3370

HU 4500 - Senior Seminar in English

A course especially designed for English majors. In depth exploration of various topics with special emphasis on theory and production. Students will be required to engage relevant secondary sources and theory in a longer, final seminar paper.
Credits: variable to 6.0
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

HU 4501 - BA Thesis

Students will be required to engage relevant secondary sources and theory in a longer, final seminar paper or creative project. Produce a cultural final project that demonstrates advanced critical and creative analysis. Proposals must be approved in the prior semester.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

HU 4600 - Humanities Internship

Provides internship experience directly related to student's course of study. Students conduct work at internship site in addition to academic assignments that encourage them to connect their professional and academic experience. Requires approval of department internship coordinator.
Credits: variable to 6.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of department required

HU 4625 - Risk Communication

Examines models for communicating risks associated with environmental, safety, and health hazards. Considers the diverse roles assumed by the public under each of these models and means of ensuring that risks are communicated fairly, honestly, and accurately.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015

HU 4628 - Usability Evaluation and Testing

Theories and practices of usability evaluation and testing relevant to technical communication contexts.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015 and (HU 2600 or HU 3120)

HU 4632 - Special Topics in Usability and User Experience

In-depth examination of selected topics in usability and user experience, such as research methods, accessibility, interaction design, design for specific demographics, information architecture, and emerging methodologies.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015

HU 4635 - Principles of User Experience Design

Teaches user-centered design methods and methodologies common to technical communication and their application to interface design, software systems, and communication projects such as websites.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015 and HU 2645

HU 4642 - Advanced Topics in Media

Critical and/or applied topics in advanced media, theory and development. Topics may include game design, mobile media, color, photography, film, or graphic design.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-2-3)
Semesters Offered: On Demand
Pre-Requisite(s): HU 2633 or HU 2645

HU 4690 - Special Topics in Technical and Professional Communication

In-depth examination of selected topics in scientific and technical communication, or on professional and workplace writing in selected genres such as reports, proposals, or whitepapers.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

HU 4698 - STC Portfolio

Instruction in the design, organization, and presentation of a professional online portfolio for science and technical communication.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Scientific & Tech Comm (BS), Scientific & Tech Comm (BA); Must be enrolled in one of the following Class(es): Senior

HU 4700 - Topics in Philosophy

The topics will ordinarily be in-depth examinations of a particular philosopher or philosophical problem, tradition, or historical period. Examples include the philosophy of Kant, the existence of God, American pragmatism, death and dying, and ancient Greek philosophy.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 4701 - Political Philosophy

Issues in political philosophy, such as the moral foundations of political systems, the proper relation between the individual and the state, and the justification of social institutions. Philosophers studied may include Plato, Aristotle, Machiavelli, Hobbes, Locke, Marx, de Tocqueville, Mill, Dewey, and Rawls.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

HU 4710 - Sports Medicine and Ethics

Examines ethical issues in sports medicine. Topics include the ethical responsibilities and conflicts of interest for team physicians, research on athletes, sport-related concussions, and doping. Philosophical ethical foundations, and professional ethical codes for sports medicine will be studied.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

HU 4711 - Biomedical Research Ethics

Examination of bioethical issues in biomedical research. Topics include research on human subjects, on vulnerable populations, and animals, principles of ethical research, and societal expectations for researchers.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): HU 3711

HU 4725 - Existentialism and Phenomenology

Introduction to the philosophical traditions of existentialism and phenomenology. Topics might include: the nature of human existence and of freedom; the importance of world, self, anxiety, death, and authenticity; and the foundations of knowledge, experience and meaning.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): UN 1015

HU 4810 - Communication, Culture, and Media Senior Seminar

Senior seminar course extending students' knowledge and skills in a chosen specialty of communication, cultural studies, and media through independent research, project design, media development, or other culminating activity.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Communication, Culture & Media; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): HU 2810 and HU 2820 and HU 2830

HU 4890 - Topics in Communication

In-depth examination of selected issues or problems in the study of communication, such as gender and communication, the environment and communication, sound and communication, violence and communication.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

Kinesiology & Integrative Physiology

KIP 1000 - Introduction to Exercise Science

Introduction to the fields and career opportunities with a kinesiology degree.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

KIP 1500 - Foundations of Kinesiology

Introduces academic subdisciplines of kinesiology - anatomy, motor behavior, biomechanics, physiology, exercise and the environment, sport nutrition and the mind and brain in exercise. Provides the conceptual framework within which the scientific bases for movement during exercise, sport performance, and other forms of physical activity are studied.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer

KIP 1900 - Student Athlete 101

Read, discuss, and practice study skills, cognitive strategies, goal development, and address contemporary issues problematic in today's college environment.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Permission of department required

KIP 2000 - Professionalism in Kinesiology

This course will assist students in gaining skills for entering into career-focused roles with professional competency, learning to apply these skills through shadowing experiences, and preparing to transition from a college student to a professional in kinesiology.
Credits: 2.0
Lec-Rec-Lab: (1-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Sports and Fitness Management, Exercise Science

KIP 2100 - Introduction to Athletic Training

Covers first aid, adult CPR, child CPR, and other sport training issues. Students receive appropriate certification cards.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall, Spring

KIP 2200 - Health Promotion

This course emphasizes methods in planning, designing, implementing, and improving health/wellness promotion programs. Client motivation, behavior change, and physical activity for special populations will be addressed.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): KIP 1500

KIP 2300 - Sports and Fitness Leadership

Course is designed to help students succeed in leadership principles, effective communication, team work, and introspection. Students will lead, teach, and collaborate with their peers through different assignments and active participation in class.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, in odd years

KIP 2400 - Principles of Sports Officiating

Theory and practice of officiating various sports common in the community and school setting.
Credits: 2.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall, in even years

KIP 2450 - Water Safety Instructor

This course is to train instructor candidates to teach courses and presentation in the American Red Cross swimming and water safety program by developing their understanding of how to use the course materials, how to conduct training sessions, and how to evaluate participants' progress.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Spring
Co-Requisite(s): PE 1480

KIP 2470 - Lifeguard First Aid

Lecture, demonstration, and practice of first aid knowledge and skills. Adult, child, and infant CPR skills will be covered as well as AED.
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Co-Requisite(s): PE 1470

KIP 2500 - Athletic Training Practicum

An experiential learning course in which students assist certified athletic trainers in preventive and post-injury care of collegiate athletes. Topics include professionalism, acute injury prevention techniques, and post-injury management and care.
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Pre-Requisite(s): KIP 2100

KIP 2600 - Introduction to Public Health

An overview of public health including the history of public health and major issues facing the U.S. and global populations. Topics include societal conditions that lead to health disparities, role of government, and the basic sciences supporting public health.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

KIP 2610 - Outdoor Emergency Care Training (Ski Patrol)

Second of two-course sequence required for Alpine and Nordic Ski Patrol candidates. Ninety hours of instruction includes three weekends. Requires payment of dues to become member of National Ski Patrol. Certification in National Ski Patrol Outdoor Emergency Care is available upon completion.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall
Restrictions: Permission of instructor required
Pre-Requisite(s): PE 2028

KIP 2700 - Essential Biochemistry

This course will provide a broad understanding of chemical and biological events happening in living systems. It covers the topics including the structure and functional relationship of biological molecules, the metabolic pathways central to biological function, and biochemistry of certain inherited genetic diseases.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore, Junior, Senior
Pre-Requisite(s): BL 1200 or BL 1400 or CH 1150

KIP 2800 - Special Topics in Kinesiology

Examination of current topics in the field of kinesiology. Literature and research topics are addressed.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Sports and Fitness Management, Exercise Science

KIP 3000 - Sports Psychology

Overview of psychological principles and their applications to individuals and groups in sport, exercise and/or therapy. For the laboratory portion, students observe and analyze behaviors in a setting of their choice.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring, Summer
Pre-Requisite(s): PSY 2000

KIP 3100 - Exercise Assessment and Prescription

Theory and practical aspects of exercise testing and prescription; topics include testing of strength, endurance, cardiovascular endurance, flexibility, body composition, muscle power, and balance with special considerations for arthritis, osteoporosis, dyslipidemia, immunology, and metabolic syndrome.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2020 and BL 2021

KIP 3150 - Functional Anatomy

Students will acquire detailed knowledge of joint movements and muscle actions involved in exercise, activities of daily living and workplace tasks. This course delivers necessary theoretical background in functional anatomy, highlighting its close link with biomechanics, thus enhancing understanding of movement processes and injury risk.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring

KIP 3200 - Personal Training

A pragmatic course of both theory and application in setting up a personal training program for individuals. Includes assessment, techniques, planning, safety and legal issues. Leads toward final preparation to earn certification as a personal trainer.
Credits: 2.0
Lec-Rec-Lab: (1-0-1)
Semesters Offered: Spring
Pre-Requisite(s): BL 2020 and BL 2021 and KIP 3100

KIP 3300 - Foundations of Coaching

Practical and relevant information appropriate for beginning and experienced interscholastic coaches.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall, Summer

KIP 3310 - Coaching Methods and Principles

Designed to provide students with basic information about coaching. Planning and organizing practice and competition, selecting appropriate drills, teaching and analyzing fundamental skills, evaluating performance, understanding basic strategies.
Credits: 2.0
Lec-Rec-Lab: (1-1-0)
Semesters Offered: Spring, in odd years

KIP 3400 - Sports Administration

Students will learn skills and competencies of sports management including ethics, marketing, law, finance, information, collegiate, olympic, professional, youth, campus recreation programs, parks, career opportunities, foundations, and future directions.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman

KIP 3410 - Facilities & Events Management

Students will learn about managing sports facilities including risk management, administration of personnel, organization, and administrative efficiency.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman

KIP 3500 - Sports Medicine Practicum

This course allows students to experience current topics in sports medicine along with learning up-to-date orthopedic injury assessment, treatment, and rehabilitation.
Credits: 1.0
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Pre-Requisite(s): KIP 2500

KIP 3700 - Lifetime Fitness

To gain a thorough understanding in all areas of personal fitness through functional anatomy, exercise physiology, health and physical fitness, screening and evaluation, nutrition, weight management, exercise prescription and programming considerations, training instruction, and consideration for special populations.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Summer

KIP 4000 - Sports Nutrition Seminar

Human nutrition as it specifically applies to athletes. Specific needs for proteins, carbohydrates, fats, electrolytes and micronutrients. Use of ergogenic aids is covered. Students will research, write and present orally their findings on nutrition topics.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2940

KIP 4100 - Exercise Physiology

Focuses on the functional changes brought by acute and chronic exercise sessions. Topics include muscle structure and function, bioenergetics, cardiovascular and respiratory adaptations, exercise training for sport, sport nutrition, ergogenic aids, and other health and fitness topics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Co-Requisite(s): KIP 4110
Pre-Requisite(s): BL 2020 and BL 2021

KIP 4110 - Exercise Physiology Laboratory

Hands-on experience in making physiological measurements as related to exercise. Cardiovascular and respiratory changes during exercise will be monitored. A virtual lab is used to simulate changes in physiological measurements that cannot be performed on live subjects. A student designed laboratory project is required.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Co-Requisite(s): KIP 4100

KIP 4120 - Molecular Exercise Physiology

Introduces cellular and molecular mechanisms by which exercise causes adaption. Topics include how gene variations affect human performance, signal transduction pathways involved in regulation of metabolism, and mechanism of exercise in prevention and treatment of chronic diseases.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): KIP 2700 and KIP 4100

KIP 4200 - Biomechanics of Human Movement

An in-depth view of the biomechanical properties of the musculoskeletal system. The course provides detailed analyses of the kinetics of human movement, material properties of the component tissues, and dynamic processes of adaptation to stress and strain of the system.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Co-Requisite(s): KIP 4210
Pre-Requisite(s): BL 2020 and KIP 1500 and PH 1110 and PH 1111

KIP 4210 - Biomechanics of Human Movement Laboratory

Hands-on experience, including data collection, analysis, and interpretation using various equipment in biomechanics. equipment in biomechanics.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Co-Requisite(s): KIP 4200
Pre-Requisite(s): BL 2020 and KIP 1500 and PH 1110 and PH 1111

KIP 4250 - Ergonomics

Introduction to ergonomics and work measurement with an emphasis on people in built and occupational environments. Discussion of methods for ergonomic assessment, evolution, and work measurement, with major topics including productivity and performance, manual materials handling, work-related musculoskeletal disorders, safety, training, legal issues, and adapting environments for special populations.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

KIP 4300 - Motor Learning and Control

This course will provide the current theories and concepts involved in the processes of motor skill acquisition and performance from a behavioral perspective.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): KIP 1500 and BL 2020

KIP 4310 - Neural-Endocrine Physiology

This course will focus on understanding how the neural and the endocrinal system are regulated under physiological condition and pathophysiological states. The major objective of this course is to prepare students to develop critical thinking and problem solving skills related to the function Neural/Endocrine system.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Pre-Requisite(s): BL 2020

KIP 4350 - Motor Development

Designed for upper level undergraduates or graduates, this course will focus on the changes in motor behavior across a life span, and examine the study and practice of fundamental patterns within the context of development theory.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): KIP 1500 and BL 2020

KIP 4400 - Strength and Conditioning

Theory and practice in development and administration of comprehensive strength and conditioning programs for both the athlete and individual of any level. Includes knowledge, safety concerns and skill techniques necessary for teaching and administering at any strength and conditioning facility.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall
Pre-Requisite(s): BL 2020 and BL 2021

KIP 4500 - Athletic Training Capstone

Experiential learning that engages students with mentorship and assisting certified athletic trainers through a complete season with one team. This course allows students to engage with injuries from onset through complete rehabilitation and return to play.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): KIP 3500

KIP 4600 - Sports and Fitness Promotions

Development and implementation of marketing plans for sports and fitness businesses. Topics include marketing of sporting events and fitness programs, use of traditional media for promotion, web-based advertising (new media), and business branding.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): MKT 3000

KIP 4610 - Legal Issues in Sports and Fitness Management

Review of legal issues that apply to sport and fitness organizations such as liability, risk management, facility concerns, and labor laws. Basic components of the U.S. legal system and guidelines, and rules of the National Collegiate Athletic Association will be covered.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

KIP 4620 - Sports Media

This course examines the impact sports and the media have on each other and the sports consumer. Students will gain a greater understanding of the operation of sports media and communications at all levels of sports (amateur, collegiate, professional) and the role of sports media in American society.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MKT 3000

KIP 4630 - Financial Aspects of Sports

Designed for upper level undergraduates or graduates, this course will focus on the changes in motor behavior across a life span, and examine the study and practice of fundamental patterns within the context of development theory.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): KIP 1500 and BL 2020

KIP 4690 - Coaching Practicum

Students seeking coaching endorsement assist with a sport of their choice. Subject to approval of endorsement advisor, students may assist a head coach in season during student teaching; assist MTU head coach in season; assist head coach in season at public/private school or summer camp.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required
Pre-Requisite(s): KIP 3000 and KIP 3300

KIP 4700 - EKG Interpretation

Course is designed for students who are going to pursue future career related to cardiac rehabilitation, physical therapy and students in the Pre-Med program. Students will learn cardiac electrophysiology, the pathophysiology, the diagnosis, and treatment of cardiac arrhythmias, and related cardiovascular diseases. Class will build bridge between basic sciences and human health.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2020 and BL 2021

KIP 4710 - Sports Medicine and Ethics

Examines ethical issues in sports medicine. Topics might include the ethical responsibilities and conflicts of interest for team physicians, research on athletes, sport-related concussions, and doping. Philosophical ethical foundations, and professional ethical codes for sports medicine will be studied.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

KIP 4720 - Exercise Pharmacology

Course will bridge between basic sciences and human health. The course focuses on understanding the fundamental concept of exercise pharmacology and pharmacological treatment of diseases of various systems including cardiovascular, respiratory, endocrine, neuronal, hormonal, and renal systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): BL 2020 and BL 2021

KIP 4730 - Physical Therapy Seminar

Seminar for students who are interested in physical therapy profession. Course will include self-directed learning and group work. Topics may include evidence based medicine, literature review writing and evaluation, healthcare reimbursement, clinical decision making, health screenings, and other current topics.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BL 2020 and BL 2021

KIP 4740 - Epidemiology

An introduction to the principles and methods of epidemiology to understand the distribution and determinants of health in a population. Topics include basic epidemiological statistics, study design, and sources/impact of bias and error.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

KIP 4800 - Special Topics in Kinesiology

Examination of current topics in the field of exercise science. Literature and research topics are addressed.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Sports and Fitness Management, Exercise Science; May not be enrolled in one of the following Class(es): Freshman, Sophomore

KIP 4900 - Internship in Exercise Science

Practical and didactic training in Exercise Science in an approved internship site. Provides experience in a variety of exercise science or medical settings. Internships must be approved by the department internship coordinator and work 42 hours for each credit earned.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Exercise Science; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): KIP 2000

KIP 4910 - Internship in Sports and Fitness Management

Empirical experiences in an approved internship site. Provides practical experience in one or more work settings, assisting the upper level student in making an appropriate career choice. Internships must be approved by the department internship coordinator and work 42 hours for each credit earned.
Credits: variable to 12.0; Repeatable to a Max of 12
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Sports and Fitness Management; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): KIP 2000

KIP 4950 - Research in Kinesiology

A literature and laboratory research experience in kinesiology that culminates in a written report or oral presentation of the work performed.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required

Mathematical Sciences

MA 0050 - College Mathematics Prep Lab

A study of basic mathematics skills used in entry level mathematics courses. Students who do not meet the prerequisites for MA1030 College Algebra I, but wish to eventually take that course should register for MA0050 to improve their foundational mathematics skills.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

MA 1020 - Quantitative Literacy

Stresses the role of contemporary mathematical thinking and the connection between mathematics and our daily lives. Topics may include problem solving and logic, sets, voting systems, graphs, number systems, geometry, mathematics of finance, combinatorics, and probability and statistics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Anthropology, Communication, Culture & Media, Comm and Culture Studies, Theatre & Electr. Media Perf., English, Theatre & Entertain Tech (BS), Theatre & Entertain Tech (BA), Liberal Arts, Nursing, Pre-Nursing, Psychology, Sports and Fitness Management, History, Social Sciences, Liberal Arts with History Opt, Sustainability Sci and Society, Scientific & Tech Comm (BA), Scientific & Tech Comm (BS), Humanities
Pre-Requisite(s): ALEKS Math Placement >= 00 or ACT Mathematics >= 10 or SAT MATH SECTION SCORE-M16 >= 260

MA 1030 - College Algebra I

This course is the first of a two semester sequence. It examines the behavior of linear, polynomial, and rational functions. In addition, algebraic methods commonly needed in calculus are reviewed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): ALEKS Math Placement >= 40 or ACT Mathematics >= 18 or SAT MATH SECTION SCORE-M16 >= 500

MA 1031 - College Algebra II with Trigonometry

This course is the second of a two semester sequence. It examines the behavior of exponential, logarithmic, and trigonometric functions. Also, algebraic and trigonometric methods commonly needed in calculus are reviewed. MA1030 and MA1031 together are equivalent to MA1032.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 1030

MA 1032 - Precalculus

This course examines the behavior of linear, polynomial, rational, exponential, logarithmic and trigonometric functions.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): ALEKS Math Placement >= 61 or ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540

MA 1120 - Single-Variable Calculus with Integrated Precalculus I

Introduction to single-variable calculus with precalculus review. Topics include behavior of elementary functions, limits, continuity, differentiation, and applications. Integrates symbolic tools, graphical concepts, data, and numerical calculations.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540 or ALEKS Math Placement >= 61

MA 1121 - Single-Variable Calculus with Integrated Precalculus II

Introduction to single-variable calculus with precalculus review. Topics include further applications of derivatives, definite and indefinite integrals, the fundamental theorem of calculus, basic integration techniques, and applications. Integrates symbolic tools, graphical concepts, data and numerical calculations.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): MA 1120

MA 1135 - Calculus for Life Sciences

Topics include limits, continuity of functions, transcendental functions, derivatives, integrals, and applications of the derivative in the fields of economics, biological sciences, and social sciences. Credit applicable only to those curricula specifying this course.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): MA 1032 or MA 1031 or MA 1120 or ALEKS Math Placement >= 76 or CEEB Calculus AB >= 2 or CEEB Calculus BC >= 2 or CEEB Calculus AB Subscore >= 2 or ACT Mathematics >= 26 or SAT MATH SECTION SCORE-M16 >= 610

MA 1160 - Calculus with Technology I

An introduction to single-variable calculus, which includes a computer laboratory. Topics include trigonometric, exponential, and logarithmic functions, differentiation and its uses, and basic integration. Integrates symbolic tools, graphical concepts, data and numerical calculations.
Credits: 4.0
Lec-Rec-Lab: (0-3-1)
Semesters Offered: Fall
Pre-Requisite(s): ALEKS Math Placement >= 86 or CEEB Calculus AB >= 3 or CEEB Calculus BC >= 3 or CEEB Calculus AB Subscore >= 3 or ACT Mathematics >= 29 or SAT MATH SECTION SCORE-M16 >= 680

MA 1161 - Calculus Plus w/ Technology I

An introduction to single-variable calculus, which includes a computer laboratory. Topics include trigonometric, exponential, logarithmic functions, differentiation and its uses, and basic integration. Integrates symbolic tools, data and numerics, and graphical concepts and is similar to MA1160, going at a different pace.
Credits: 5.0
Lec-Rec-Lab: (0-4-1)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1032 or MA 1031 or MA 1120 or ALEKS Math Placement >= 76 or CEEB Calculus AB >= 2 or CEEB Calculus BC >= 2 or CEEB Calculus AB Subscore >= 2 or ACT Mathematics >= 26 or SAT MATH SECTION SCORE-M16 >= 610

MA 1600 - Introduction to Scientific Simulation

Introduction to simulation, a powerful computational tool for many scientific problems. Case studies and projects will be drawn from various fields. Prior programming experience is not required; all necessary computational skills will be developed in the course.
Credits: 3.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Pre-Requisite(s): MA 1160 or MA 1161 or MA 1121

MA 1910 - Exploring Symmetry Groups

Mathematical discovery and invention in group theory: transformations, finite figures, strip patterns, wall patterns, finite groups, and Cayley diagrams. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years

MA 1920 - Exploring Knots and Surfaces

Mathematical discovery and invention in topological graph theory: networks, graphs, graph coloring, surfaces and graphs, and knots. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years

MA 1930 - Exploring Number Theory

Mathematical discovery and invention in number theory: number puzzles, Chinese Remainder Theorem, codes, primitive roots, and quadratic reciprocity. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years

MA 1940 - Exploring Non-Euclidean Geometry

Mathematical discovery and invention in Non-Euclidean geometry: definitions of straight and angle, transformations, congruence, parallel transport, projections, and finite geometries. Develops the ability to find and describe patterns, to generalize from observations, to formulate conjectures, and to support conjectures with analysis and, when possible, formal proof.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years

MA 1990 - Elementary Mathematics Topics

Students study a particular area in mathematics, ordinarily not covered in existing courses. Intended for first-year students.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MA 2160 - Calculus with Technology II

Continued study of calculus, which includes a computer laboratory. Topics include integration and its uses, function approximation, vectors, and elementary modeling with differential equations.
Credits: 4.0
Lec-Rec-Lab: (0-3-1)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1160 or MA 1161 or MA 1135 or MA 1121 or CEEB Calculus AB >= 3 or CEEB Calculus BC >= 3 or CEEB Calculus AB Subscore >= 3

MA 2320 - Elementary Linear Algebra

An introduction to linear algebra and how it can be used. Topics include systems of equations, vectors, matrices, orthogonality, subspaces, and the eigenvalue problem.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Mathematics, Software Engineering, Computer Science
Pre-Requisite(s): MA 1160 or MA 1161 or MA 1135 or MA 1121

MA 2321 - Elementary Linear Algebra

Offered first half of semester, to be taken concurrently with MA3521. The course is an introduction to linear algebra and how it can be used. Topics include systems of equations, vectors, matrices, orthogonality, subspaces and the eigenvalue problem.
Credits: 2.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Mathematics, Software Engineering, Computer Science
Co-Requisite(s): MA 3521
Pre-Requisite(s): MA 2160

MA 2330 - Introduction to Linear Algebra

An introduction to linear algebra and how it can be used, including basic mathematical proofs. Topics include systems of equations, vectors, matrices, orthogonality, subspaces, and the eigenvalue problem.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 1160 or MA 1161 or MA 1135 or MA 1121

MA 2600 - Scientific Computing

Use of mathematical modeling and computer simulation to solve scientific problems. Includes introduction to elementary numerical methods (numerical integration, solution of linear systems, solution of nonlinear equations, optimization) and to computer programming. Requires programming project(s).
Credits: 3.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Pre-Requisite(s): MA 2160 and (MA 2320 or MA 2321 or MA 2330)

MA 2710 - Introduction to Statistical Analysis

Introduction to statistical reasoning and methods. Topics include uses and abuses of statistics, graphical and descriptive methods, correlation and regression, probability and statistical inference. The course will include a written project and an introduction to statistical software.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Statistics, Mathematics, Mathematics & Computer Science, Data Science, Business Analytics
Pre-Requisite(s): MA 1160 or MA 1161 or MA 1135 or MA 1121

MA 2720 - Statistical Methods

Introduction to the design and analysis of statistical studies. Topics include methods of data collection, descriptive and graphical methods, probability, statistical inference on means, regression and correlation, and ANOVA.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Mathematics
Pre-Requisite(s): MA 1020 or MA 1030 or MA 1120 or MA 1032 or MA 1031 or ALEKS Math Placement >= 61 or CEEB Calculus BC >= 2 or CEEB Calculus AB Subscore >= 2 or ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540

MA 2990 - Elementary Topics in Mathematics

Students study a particular area in mathematics ordinarily not covered in existing courses. Intended for first- or second-year students.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MA 3160 - Multivariable Calculus with Technology

Introduction to calculus in two and three dimensions, which includes a computer laboratory. Topics include functions of several variables, partial derivatives, the gradient, multiple integrals; introduction to vector-valued functions and vector calculus, divergence, curl, and the integration theorems of Green, Stokes, and Gauss.
Credits: 4.0
Lec-Rec-Lab: (0-3-1)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 2160 or CEEB Calculus BC >= 3

MA 3202 - Introduction to Coding Theory

Transmission via noisy channels, hamming distance, linear codes, the ISBN-code, encoding and decoding, finite fields, Reed-Solomon codes, deep space communication, the compact disk code, sphere packing bound, hamming codes, hamming decoding.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3203 - Introduction to Cryptography

Topics include private-key cryptography, shift substitution, permutation and stream ciphers, cryptanalysis, perfect secrecy, public-key cryptography, and the RSA cryptosystem.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3210 - Introduction to Combinatorics

Topics include set theory, mathematical induction, integers, functions and relations, counting methods, recurrence relations, generating functions, permutations, combinations, principle of inclusion and exclusion, graphs (including planar graphs). Further possible topics are graph coloring, trees and cut-sets, combinatorial designs, Boolean algebra.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3310 - Introduction to Abstract Algebra

Introduction to proofs in algebra. Topics include elementary number theory (induction, binomial theorem, fundamental theorem of arithmetic, Euclidean algorithm, congruences, Fermat's theorem), group theory (subgroups, cyclic groups, generators, Lagrange's theorem, normal groups, homomorphisms, quotients), ring theory (domains, fields, polynomials, homomorphisms).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 3450 - Introduction to Real Analysis

Why calculus works: a careful study of the logical basis of calculus, with an emphasis on how to read and write proofs. Topics include set theory, real numbers, infinite sequences, continuity, derivatives and integrals for functions of one variable, sequences of functions, infinite series.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 2160

MA 3520 - Elementary Differential Equations

First order equations, linear equations, and systems of equations.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Mathematics, Computer Science
Pre-Requisite(s): MA 2160 and (MA 2320 or MA 2321 or MA 2330)

MA 3521 - Elementary Differential Equations

Offered second half of semester, to be taken concurrently with MA2321. Topics include first order equations, linear equations and systems of equations.
Credits: 2.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Major(s): Mathematics, Computer Science
Co-Requisite(s): MA 2321
Pre-Requisite(s): MA 2160

MA 3530 - Introduction to Differential Equations

First order equations, linear equations, systems of equations, and Laplace transforms. May include elementary separation of variables for partial differential equations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 2160 and (MA 2320 or MA 2321 or MA 2330)

MA 3560 - Mathematical Modeling with Differential Equations

Creating differential equation models for physical problems such as population dynamics, kinetics, mass-spring systems. Topics include nondimensionalization, numerical methods, phase-plane analysis, first-order systems, linearization, and stability. Includes modeling case studies, using a computer algebra system, and a modeling project.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 2160 and (MA 2320 or MA 2321 or MA 2330)

MA 3710 - Engineering Statistics

Introduction to the design, conduct, and analysis of statistical studies aimed at solving engineering problems. Topics include methods of data collection, descriptive and graphical methods, probability and probability models, statistical inference, control charts, linear regression, design of experiments.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 2160 or MA 3160(C)

MA 3715 - Biostatistics

Introduction to the design and analysis of statistical studies in the health and life sciences. Topics include study design, descriptive and graphical methods, probability, inference on means, categorical data analysis, and linear regression.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 1135 or MA 1160 or MA 1161 or MA 1121 or MA 2160(C) or MA 3160(C)

MA 3720 - Probability

Introduction to probabilistic methods. Topics include probability laws, counting rules, discrete and continuous random variables, expectation, joint distributions, and limit theorems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MA 2160

MA 3740 - Statistical Programming and Analysis

Project-based course enabling students to identify statistical methods and analysis using R. Topics include exploratory data analysis, classical statistical tests, sample size and power considerations, correlation, regression,and design experiments using advanced programming techniques.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710 or MA 3715

MA 3750 - Introduction to SAS Programming

This course is a workshop focused on solving problems for SAS certified base/certified programmers for SAS credentials.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710 or MA 3715

MA 3810 - Introduction to Actuarial Mathematics

Nominal and effective rates of interest, present value, discount, annuities certain, sinking funds, bonds, yield rates, and amortization schedules. Financial calculator skills for professional exams. Immunization, swaps, interest rate policy. May include other topics on the FM exam.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3160(C)

MA 3811 - Actuarial Exam Workshop

Topics from the Society of Actuaries professional examinations, primarily financial mathematics and probability. Review, preparation, and practice using SOA exams and other materials.
Credits: 1.0; Repeatable to a Max of 4; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 3160

MA 3924 - College Geometry with Technology

Review of Euclidean geometry. Introduction to geometric constructions, conjecturing of theorems, methods of proof, 3-D geometry, finite geometries, and non-Euclidean geometries. Integrates computer software (e.g. Geometer's Sketchpad) throughout the course.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 2160 or MA 2330

MA 3990 - Math Sciences Teach Experience

Development of teaching skills through assisting in the instruction of a section of an entry-level undergraduate mathematics course. Students gain experience in leadership, group work, organization skills, cooperative exercise preparation, and class instruction.
Credits: variable to 4.0; Repeatable to a Max of 4; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MA 3999 - Intermediate Topics in Mathematics

Students study a particular area in mathematics, not ordinarily covered in existing courses. Intended for third-year students.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MA 4208 - Optimization and Graph Algorithms

An introduction to linear and integer programming and related graph problems. Topics include simplex algorithm, duality, branch-and-bound and branch-and-cut, shortest paths, spanning trees, matchings, network flow, graph coloring, and perfect graphs.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3210 or CS 2311

MA 4209 - Combinatorics and Graph Theory

An introductory course in combinatorics and graph theory. Topics include designs, enumeration, extremal set theory, finite geometry, graph coloring, inclusion-exclusion, network algorithms, permutations, and trees.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3210 or CS 3311

MA 4310 - Abstract Algebra

Detailed study of abstract algebra: elementary number theory (congruences, quadratic residues, arithmetic functions), group theory (monoids, permutation groups, homomorphisms, quotients, Lagrange's theorem, finite abelian groups, Sylow's theorems), ring theory (domains, prime and maximal ideals, quotients, PID's), splitting fields, finite fields.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3310

MA 4330 - Linear Algebra

A study of fundamental ideas in linear algebra and its applications. Includes review of basic operations, block computations; eigensystems of normal matrices; canonical forms and factorizations; singular value decompositions, pseudo inverses, least-square applications; matrix exponentials and linear systems of ODEs; quadratic forms, extremal properties, and bilinear forms.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 2320 or MA 2321 or MA 2330) and MA 3160

MA 4410 - Complex Variables

A study of complex numbers, functions of a complex variable, analytic functions, elementary functions, integrals, Taylor and Laurent series, residues and poles, and conformal mapping.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3160

MA 4450 - Real Analysis

Real analysis on Euclidean n-space. Topics include real and vector valued functions, metric and normed linear spaces; an introduction to Lebesgue measure and convergence theorems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 2320 or MA 2321 or MA 2330) and MA 3160 and MA 3450

MA 4515 - Introduction to Partial Differential Equations

An introduction to solution techniques for linear partial differential equations. Topics include: separation of variables, eigenvalue and boundary value problems, spectral methods, fourier series, and Green's functions. Studies applications in heat and mass transfer (diffusion eqn.), and mechanical vibrations (wave and beam eqns.).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

MA 4525 - Applied Vector and Tensor Mathematics

Introduction to vector and tensor mathematics with applications. Topics include vectors; vector differential calculus, space curves; dyadic products and matrices; gradients, divergence, curl, Laplacians; Stokes' integral theorem, Gauss theorem, conservation laws; curvilinear coordinates; tensors, material derivatives; applications of potential theory in electricity and magnetism, heat transfer, solid and fluid mechanics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3160 and (MA 2320 or MA 2321 or MA 2330)

MA 4535 - Nonlinear Dynamics and Chaos

Ordinary differential equations and dynamical systems via a modern geometric approach, including physical and engineering applications. May include chaotic phenomena and fractals.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

MA 4610 - Numerical Linear Algebra

Design and analysis of algorithms for problems in linear algebra. Covers floating point arithmetic, condition numbers, error analysis; solution of linear systems (direct and iterative methods), eigenvalue problems, least squares, and singular value decomposition. Includes the use of appropriate software.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 2320 or MA 2321 or MA 2330

MA 4620 - Numerical Methods for PDEs

Derivation, analysis, and implementation of numerical methods for partial differential equations; applications to fluid mechanics, elasticity, heat conduction, acoustics, or electromagnetism.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 3520 or MA 3521 or MA 3530 or MA 3560) and MA 3160

MA 4700 - Probability and Statistical Inference I

Introduction to probabilistic methods. Topics include probability laws, counting rules, discrete and continuous random variables, moment generating functions, expectation, joint distributions, and the Central Unit Theorem.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required
Pre-Requisite(s): MA 3160 and (MA 2710 or MA 2720 or MA 3710 or MA 3715)

MA 4705 - Probability and Statistical Inference II

Topics include sampling distributions, theory of point and interval estimation, properties of estimators, and theory of hypothesis testing.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Permission of department required
Pre-Requisite(s): MA 4700

MA 4710 - Regression Analysis

Covers simple, multiple, and polynomial regression; estimation, testing, and prediction; weighted least squares, matrix approach, dummy variables, multicollinearity, model diagnostics and variable selection. A statistical computing package is an integral part of the course. Some prior experience with R is expected.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710 or MA 3715 or MA 5701

MA 4720 - Design and Analysis of Experiments

Covers construction and analysis of completely randomized, randomized block, incomplete block, Latin squares, factorial, fractional factorial, nested and split-plot designs. Also examines fixed, random and mixed effects models and multiple comparisons and contrasts. The R programming language is an integral part of the course.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710 or MA 3715 or MA 5701

MA 4730 - Nonparametric Statistics

Introduces nonparametric techniques that require less restrictive assumptions on the data. Topics include statistical inference concerning location and dispersion parameters as well as the general distributions. Goodness-of-fit tests for count and ordinal data are also discussed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710 or MA 3715

MA 4760 - Mathematical Statistics I

Covers joint probability distributions, functions of random variables, sampling and limiting distributions, introduction to parameter estimation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MA 3720 or EE 3180) and MA 3160

MA 4770 - Mathematical Statistics II

Continuation of MA4760. Theory of point and interval estimation; properties of estimators, theory of hypothesis testing, analysis of variance, analysis of categorical data and other topics as time allows
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 4760

MA 4780 - Time Series Analysis and Forecasting

Statistical modeling and inference for analyzing experimental data that have been observed at different points in time. Topics include models for stationary and nonstationary time series, model specification, parametric estimation, and time regression models. Some prior experience with R is expected.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (MA 2710 or MA 2720 or MA 3710 or MA 3715) and (MA 3720 or EE 3180)

MA 4790 - Predictive Modeling

Application, construction, and evaluation of statistical models used for prediction and classification. Topics include data visualization and exploratory methods, the normal theory regression model, logistic and Poisson regression, linear and quadratic discriminant analysis, and classification with logit models. Some prior experience with R is expected.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3740 or MA 4710 or MA 4720 or MA 4780

MA 4810 - Financial Markets and Actuarial Math

Derivative securities, hedging, arbitrage, binomial and Black-Scholes pricing models. Life insurance and annuities. May include other topics on professional actuarial exams.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): MA 3720 and MA 3810

MA 4820 - Loss Distributions and Actuarial Math

Loss distribution used for modeling insurance claims. Frequency, severity, coverage modifications, risk measures, models, credibility. May include other topics on professional actuarial exams.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): MA 3720

MA 4900 - Mathematical Sciences Project

Independent study in an area of mathematical sciences under the guidance of a faculty member.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MA 4908 - Theory of Numbers with Technology

Mathematical induction, Euclid's algorithm, prime and composite integers, algebra of congruences, Chinese remainder theorem, quadratic reciprocity law, number theoretic functions, first degree Diophantine equations, Pythagorean triples, Fermat and Mersenne numbers, factoring algorithms, tests for primality and various applications. Projects use Mathematica and EXCEL software packages.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MA 3210 or MA 3310 or MA 3924

MA 4945 - History of Mathematics

Survey of the development of mathematics from ancient times to today. How cultural, mathematical, and technological developments have influenced one another throughout history. Course provides all necessary historical background.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015

MA 4990 - Topics in Mathematics

Students study in greater depth a particular area of mathematics not studied in existing courses.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

Mechanical Engineering

ME 2110 - Statics

Force systems in two and three dimensions. Includes composition and resolution of forces and force systems, principles of equilibrium applied to various bodies, simple structures, friction, centroids, and moments of inertia. Vector algebra used where appropriate. Prerequisite of MA2160 with a grade of C or better is required.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of For Res & Env Sci, College of Engineering
Pre-Requisite(s): MA 2160

ME 2150 - Mechanics of Materials

Introduction to mechanical behavior of materials, including stress/strain at a point, principle stresses and strains, stress-strain relationships, determination of stresses and deformations in situations involving axial loading, torsional loading of circular cross sections, and flexural loading of straight members. Also covers stresses due to combined loading and buckling of columns.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of For Res & Env Sci, College of Engineering
Pre-Requisite(s): MEEM 2110 or ME 2110

ME 2201 - Introductory Thermodynamics

This course introduces concepts of energy, energy conversion, mechanisms of heat and work transfer in processes and in cycles. It also covers the first and the second laws of thermodynamics. Prerequisite of MA2160 with a C or better is required.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Engineering
Pre-Requisite(s): MA 2160 and CH 1150 and CH 1151

ME 2700 - Dynamics

First course in the principles of dynamics, covering the motion of a particle, the kinematics and kinetics of plane motion of rigid bodies, the principles of work and energy, impulse and momentum. Uses vector methods.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): PH 2100 and (MEEM 2110 or ENG 2120 or ME 2110)

ME 2901 - Mechanical & Aerospace Engineering Practice I

Students develop laboratory and computer skills, Topics include product dissection, data acquisition, materials testing, 2D finite element modeling, 1D modeling and simulation.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Aerospace Engineering
Pre-Requisite(s): (MEEM 2110(C) or ME 2110(C)) and ENG 1102 and UN 1015

ME 2911 - Mechanical & Aerospace Engineering Practice II

Students further develop testing and simulation skills as they validate dynamic mechanical and thermal/fluid systems. Course emphasizes application of energy conservation principles to physical engineering systems as well as analysis and communication of data.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Aerospace Engineering
Pre-Requisite(s): (MEEM 2901 or ME 2901) and (MEEM 2201(C) or ME 2201(C)) and (MEEM 2110 or ME 2110)

ME 3201 - Introductory Fluid Mechanics & Heat Transfer

Course emphasizes internal flow and modes of heat transfer: control volume analysis of mass, momentum and energy, pipe and duct flow, dimensional analysis, steady and unsteady heat conduction, internal convection and application of boundary conditions, and simple heat exchanger design.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Pre-Requisite(s): (MEEM 2201 or ME 2201) and (MEEM 2911 or ME 2911) and MA 3160

ME 3400 - Machine Design and Analysis

In this course, students apply concepts from previous classes to design and analyze mechanical systems using solid elements, bolted joints, welds, springs, spinning shafts, bearings, and gears. Students use case studies to develop relationships between design and performance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Robotics Engineering, Mechanical Engineering
Pre-Requisite(s): MSE 2100 and (ENG 2120 or MEEM 2150 or ME 2150) and (MEEM 2700 or ME 2700)

ME 3601 - Introduction to Manufacturing

This course introduces manufacturing processes and sequences with considerations of advantages and limitations. Metrology is covered alongside how GD&T affects manufacturing. Considerations of design for manufacturing and assembly are introduced. Various types of manufacturing systems and operations management are covered with economic analyses.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Aerospace Engineering
Pre-Requisite(s): ME 2901 or MEEM 2901

ME 3750 - Dynamic Systems

This course deals with the modeling, analysis and control of mixed physics systems. It covers differential equation generation for mechanical, thermal, and electrical systems, their simulation, and methods for analyzing their performance operating in both open and closed loop.
Credits: 4.0
Lec-Rec-Lab: (0-4-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Mechatronics, Aerospace Engineering
Pre-Requisite(s): (MEEM 2700 or ME 2700) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

ME 3901 - Mechanical Engineering Practice III - Model Based Design

Students apply the engineering design process by combining engineering science with simulation tools to guide design decisions. They use energy-based models to determine design direction and design-based simulation to select and optimize components and subsystems to meet design requirements.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Pre-Requisite(s): (MEEM 2911(C) or ME 2911) and (MEEM 2150 or ME 2150) and (MEEM 2700 or ME 2700)

ME 3911 - Mechanical Engineering Practice IV

Students create simulations and validation procedures to verify that components and assembled system meet desired requirements. Experimental methods, simulation, data processing, comparing experimental and analytical results, and engineering communication methods are emphasized.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Pre-Requisite(s): (MEEM 2911 or ME 2911) and (MEEM 3901(C) or ME 3901(C))

ME 3990 - Special Topics in Mech Engg

Problems in mechanical engineering, engineering mechanics, manufacturing, or industrial engineering that are not covered in regular courses.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

ME 3999 - Mechanical Engineering Undergraduate Research Project

An undergraduate research experience during the junior year in mechanical engineering. Students work directly with faculty on active research projects/grants. A report will be submitted and graded.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Mechanical Eng-Eng Mechanics, Mechanical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Senior

ME 4150 - Intermediate Mechanics of Materials

Basic concepts of three-dimensional stress and strain. Inelastic behavior of axial members, circular shafts and symmetric beams. Deflections of indeterminate beams. Unsymmetrical bending, shear flow and shear center for open sections. Energy methods for structures made up of one-dimensional elements. Introduction to theories of failures.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MEEM 2150 or ME 2150

ME 4170 - Failure of Materials in Mechanics

Identifies the modes of mechanical failure that are essential to prediction and prevention of mechanical failure. Discusses theories of failure in detail. Treats the topic of fatigue failure extensively and brittle fracture, impact and buckling failures at some length.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3400 or ME 3400

ME 4180 - Engineering Biomechanics

Engineering mechanics applied to the human body in health and disease or injury, which includes mechanics of human biological materials and engineering design in musculoskeletal system. Also studies on mechanics of posture (occupational biomechanics) and locomotion (sports biomechanics) using mathematical models of the human body.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (MEEM 2150 or ME 2150) and (MEEM 2700 or ME 2700)

ME 4200 - Principles of Energy Conversion

Introduces fundamentals of energy conversion and storage. Topics include fossil and nuclear fuels, thermodynamic power cycles, solar energy, photovoltaics, and energy storage.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MEEM 3201 or ME 3201 or CM 3230 or ENG 3200 or CEE 3200 or MSE 3100

ME 4201 - Applied Thermodynamics

This course focuses on the application of the first and second laws of thermodynamics to gas power cycles, vapor and combined power cycles, refrigeration cycles, gas mixture properties, gas-vapor mixtures and air-conditioning, and reacting mixtures (combustion).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Eng-Eng Mechanics, Mechanical Engineering
Pre-Requisite(s): MEEM 3201(C) or ME 3201(C)

ME 4202 - Applied Fluid Mechanics & Heat Transfer

Intermediate fluid mechanics and heat transfer topics are covered. These include necessary considerations of: differential analysis of fluid flows based on Navier-Stokes equations, lift and drag, convective heat transfer in external flows, radiation, and simple considerations of condensation and boiling.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Eng-Eng Mechanics, Mechanical Engineering
Pre-Requisite(s): MEEM 3201 or ME 3201

ME 4210 - Computational Fluids Engineering

This course introduces students to computational methods used to solve fluid mechanics and thermal transport problems. Computer-based tools are used to solve engineering problems involving fluid mechanics and thermal transport.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MEEM 3201(C) or ME 3201(C)

ME 4220 - Internal Combustion Engines I

This course teaches the operational principles of spark-ignition and compression-ignition internal combustion engines through the application of thermodynamics, fluid dynamics, and heat transfer. Course studies engine performance, efficiency, and emissions using cycle-based analysis, combustion thermochemistry, and compressible fluid flow.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MEEM 3201 or ME 3201

ME 4235 - Wind Energy

This course introduces students to the underlying principles of wind energy conversions, with an emphasis on engineering aspects of wind turbine design and construction, and the evaluation of wind resources.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 3201 or ME 3201

ME 4240 - Combustion & Air Pollution

Introduces sources of emissions from combustion, applies thermo-chemical principles to model the formation of pollutants, and identifies impacts of air pollutants on the environment and human health. Addresses pollution regulation and societal impacts including emissions, climate change, and air quality.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ME 2201 or MEEM 2201 or ENG 3200 or CEE 3200

ME 4250 - Heating/Ventilation/Air Cond

This course introduces the principles of heating, ventilation, and air-conditioning (HVAC) related to buildings. The simultaneous application of thermodynamics, heat transfer, and fluid mechanics is essential to solving thermal comfort, air quality, and building heating and cooling load problems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3201 or ME 3201

ME 4260 - Fuel Cell Technology

Fuel cell basics, operation principles and performance analysis. Emphasis on component materials and transport phenomena on proton exchange membrane fuel cells along with other types of fuel cells. Hydrogen production, transportation, and storage. Balance of plant and systems analysis.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): MEEM 3201 or CM 3110 or ME 3201

ME 4295 - Introduction to Propulsion Systems for Hybrid Electric Vehicles

Hybrid electric vehicle analysis will be developed and applied to examine the operation, integration, and design of powertrain components. Model based simulation and design is applied to determine vehicle performance measures in comparison to vehicle technical specifications. Power flows, losses, energy usage, and drive quality are examined over drive-cycles via application of these tools.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of Engineering, College of Computing; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MEEM 2700 or ME 2700 or EE 2112 or Graduate Status >= 1

ME 4296 - Vehicle Electrification Lab

This hands-on course examines vehicle electrification from a power and energy perspective. Topics include powertrain architecture, vehicle and component testing, fuel consumption, aerodynamics and rolling resistance, engines, batteries, electric machines, and power electronics. The course culminates with the study of system interactions with emphasis on idle reduction and regenerative braking as mechanisms for increasing fuel economy.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

ME 4404 - Mechanism Synthesis/Dynamic Modeling

Students apply kinematic synthesis techniques in design and analysis of mechanical systems. They develop synthesis software to link to dynamic analysis packages such as ADAMS, I-DEAS, Unigraphics, etc. They investigate influences of process variation on system output and learn methods to minimize the variation influences.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3400 or ME 3400 or MEEM 2700 or ME 2700

ME 4405 - Mechanism Synthesis/Dynamic Modeling

Students apply kinematic synthesis techniques in design and analysis of mechanical systems. They develop synthesis software to link to dynamic analysis packages such as ADAMS, I-DEAS, Unigraphics, etc. They investigate influences of process variation on system output and learn methods to minimize the variation influences.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3400 or ME 3400

ME 4430 - Advanced Computer Aided Design and Manufacturing Methods

Students apply advanced solid modeling techniques to construct solid models of mechanical systems, document the design using GD&T conventions as per ASME standards, simulate the motion of the system, and learn the computer aided manufacturing and additive manufacturing techniques.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Eng-Eng Mechanics, Mechanical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): ENG 1102 and (MEEM 3600 or ME 3601)

ME 4450 - Vehicle Dynamics

This course will develop the models and techniques needed to predict the performance of a road vehicle during drive off, braking, ride, and steering maneuvers. Topics to be covered include: acceleration and braking performance, power train architecture, vehicle handling, suspension modeling, tire models, and steering control. Matlab, Adams Car, and Amesim, will be used as computational tools.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following College(s): Class(es): Junior, Senior
Pre-Requisite(s): MEEM 3400 or ME 3400 or EE 3261

ME 4610 - Advanced Machining Processes

Covers mechanics of 2-D and 3-D cutting and their extension to commonly used conventional processes such as turning, boring, milling, and drilling. Topics include force modeling, surface generation, heat transfer, tool life and dynamics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3600 or ME 3601

ME 4640 - Micromanufacturing Processes

Introduces the processes and equipment for fabricating microsystems and the methods for measuring component size and system performance. Fabrication processes include microscale milling, drilling, diamond machining, and lithography. Measurement methods include interferometry and scanning electron microscopy.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (MEEM 3400(C) or ME 3400(C)) and (MEEM 3600(C) or ME 3601)

ME 4650 - Quality Engineering

Introduction to the concepts and methods of quality and productivity improvement. Topics include principles of Shewhart, Deming, Taguchi; meaning of quality; control charts for variables, individuals, and attributes; process capability analysis.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): (MEEM 3600(C) or ME 3601(C)) and (MA 3710 or MA 3720 or MA 2710 or MA 2720)

ME 4655 - Production Planning

Covers fundamental production planning topics as capacity management, facility layout, process design and analysis, forecasting, inventory management, MRP, scheduling, and theory of constraints. Introduces basic lean concepts, lean production, and value stream mapping.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): MEEM 3600(C) or ME 3601(C)

ME 4665 - Introduction to Lean Manufacturing

Introduces lean manufacturing tools, techniques, and practices. Topics include Muda, 5S, visual factory, VSM, theory of constraints, standardized work, pull system, SMED, TPM and lean assessment.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering
Pre-Requisite(s): MEEM 3600 or MEEM 3601(C)

ME 4695 - Additive Manufacturing

Background, principles, process chain, software aspects, post-processing, open-source tools, applications, and future directions of AM technologies are discussed.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): MEEM 3600(C) or MEEM 3601(C)

ME 4701 - Analytical and Experimental Modal Analysis

Combined experimental and analytical approach to mechanical vibration issues; characterization of the dynamic behavior of a structure in terms of its modal parameters; digital data acquisition and signal processing; experimental modal analysis procedures; parameter estimation for obtaining modal parameters; model validation and correlation with analytical models; structural dynamics modification.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3750 or ME 4702

ME 4702 - Vibrations

Theory and experimental techniques in vibration control, Shock, structural health monitoring, condition based maintenance, dynamic measurements, test methods, and planning.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Mechanical Eng-Eng Mechanics, Engineering Mechanics
Pre-Requisite(s): (MEEM 3911 and MEEM 3750) or MEEM 4775

ME 4704 - Acoustics and Noise Control

Analysis and solution of practical environmental noise problems. Fundamental concepts of sound generation and propagation, the unwanted effects of noise, assessment of sound quality, and source-path-receiver concepts in noise control. Lecture, measurement laboratory, and team project directed at solving a real noise problem under a client's sponsorship.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): MA 2160

ME 4705 - Robotics and Mechatronics

Cross-discipline system integration of sensors, actuators, and microprocessors to achieve high-level design requirements, including robotic systems. A variety of sensor and actuation types are introduced, from both a practical and a mathematical perspective. Embedded microprocessor applications are developed using the C programming language.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MEEM 3750 or EE 3160 or ME 3750

ME 4707 - Autonomous Systems

The main concepts of autonomous systems will be introduced including motion control, navigation, and intelligent path planning and perception. This is a hands-on project based course. Students will have the opportunity to work with mobile robotics platforms. Having a foundational understanding of programming is recommended to make the most of this course.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Robotics Engineering, Mechanical Eng-Eng Mechanics, Mechanical Engineering
Pre-Requisite(s): MEEM 3750 or ME 3750 or MEEM 4775(C) or ME 4775(C) or EE 3160

ME 4730 - Dynamic System Simulation

Methods for simulating dynamic systems described by ordinary differential equations using numerical integration are developed. Quantifying simulation errors for both batch and real-time, control system applications is covered along with numerical optimization strategies for model validation. MATLAB and Simulink are used to illustrate key concepts.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3750 or ME 3750

ME 4775 - Analysis & Design of Feedback Control Systems

This course covers topics of control systems design. Course includes a review for modeling of dynamical systems, stability, and root locus design. Also covers control systems design in the frequency domain, fundamentals of digital control and nonlinear systems.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Eng-Eng Mechanics, Mechatronics, Mechanical Engineering, Robotics Engineering
Pre-Requisite(s): MEEM 3750 or EE 3160 or ME 3750

ME 4810 - Introduction to Aerospace Engineering

Introductory course on topics relevant to aerospace engineering and science. Topics include history, properties of the atmosphere, the solar system, atmospheric and space vehicles, mission design, and vehicle design and performance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (MEEM 2150 or ME 2150 or ENG 2120) and (MEEM 3201 or ME 3201 or ENG 3200 or CEE 3200)

ME 4820 - Introduction to Aerospace Propulsion

Principles of jet propulsion, cycle analysis and component analysis (non-rotating components, compressors, turbines). Principles of rocket propulsion, chemical rockets, propellants, turbomachinery, electrical propulsion. Review of thermodynamics for fluid flow, one-dimensional gas dynamics, and boundary layer theory included.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MEEM 3201 or ME 3201

ME 4850 - Naval Systems and Platforms

Concepts of semi- and fully-autonomous naval and marine sensors and sensing platforms demonstrated through classroom learning and hands-on experiences. Laboratories will focus on operating sensors and sensor packages, in oceanographic and other applications.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): MEEM 3201 or ME 3201 or ENG 3200 or CEE 3200 or MSE 3110

ME 4901 - Senior Capstone Design I

Students work in teams on "open-ended" engineering capstone design projects - most with industrial sponsors - developing original and creative solutions to real engineering problems.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Aerospace Engineering
Pre-Requisite(s): (MEEM 3400 or ME 3400) and EE 3010(C) and (MEEM 3600(C) or ME 3601(C)) and (MEEM 3901 or ME 3901) and (MEEM 3201 or ME 3201) and (MEEM 3750 or ME 3750) and (MEEM 3911 or ME 3911) and (MA 3710(C) or MA 2710(C) or MA 2720(C)) or (MA 3710 or MA 2710 or MA 2720) and ((MEEM 3750 or ME 3750) and AE 4550(C) and AE 4560(C))

ME 4911 - Senior Capstone Design II

Design projects started in MEEM4901 are completed and evaluated using computer-aided engineering methods, physical models, and/or prototypes as appropriate.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering, Aerospace Engineering
Pre-Requisite(s): EE 3010 and (MEEM 3201 or ME 3201) and (MEEM 3600 or ME 3601) and (MEEM 3750 or ME 3750) and (MEEM 4901 or ME 4901) or (AE 3560 and AE 4550 and (MEEM 4901 or ME 4901))

ME 4990 - Special Topics in Mech Engineering

Problems in mechanical engineering, engineering mechanics, manufacturing, or industrial engineering that are not covered in regular courses.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

ME 4999 - Mechanical Engineering Senior Research Thesis

An undergraduate research experience during the senior year in mechanical engineering. Students begin work on an active research project/grant with faculty or continue work from the previous year. A thesis will be published in the department and archived.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; Must be enrolled in one of the following Major(s): Mechanical Eng-Eng Mechanics, Mechanical Engineering; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Mechanical Engineering Technology

MET 2110 - Applied Statics

Statics includes a study of forces, analysis of simple structures, equilibrium, moment of inertia, and friction.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (PH 1110 or PH 1140 or PH 2100) and (MA 1160(C) or MA 1161(C) or MA 1121(C))

MET 2130 - Applied Dynamics

Particle and rigid plane body kinematics and kinetics covers inertia force, work-energy-power and impulse-momentum methods. Emphasizes development of student skills in problem definition and problem solving.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (ENG 2120 or MET 2110 or MEEM 2110 or ME 2110) and MA 2160

MET 2150 - Applied Strength of Materials

Strength of materials considers stress and strain under axial, torsional, and bending loads. Laboratory exercises include materials testing and problem solving.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MET 2110 or MEEM 2110 or ME 2110

MET 2153 - Machine Tool Fundamentals and Applications

A study of basic machining processes: including setup and operation of lathes, milling machines, drill presses, grinders and saws. Students are exposed to fundamental machining processes, nomenclature and machine operation with an overall focus on safety and quality control.
Credits: 2.0
Lec-Rec-Lab: (0-1-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering Tech
Pre-Requisite(s): MET 2400(C) or ENG 1102

MET 2400 - Practical Applications in Parametric Modeling

Intermediate course intended to expand the student's knowledge of computer modeling techniques, introducing advanced assemblies and GD&T concepts. Investigates advanced concepts available to the designer.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechanical Engineering Tech
Pre-Requisite(s): ENG 1101 or ENG 1102 or ENG 1101T

MET 3242 - Machine Design I

An introduction to mechanical design for technology students. The coursework applies principles of statics, dynamics and mechanics of materials to the design of simple mechanical components and systems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 2160 and (MET 2150 or MEEM 2150 or ME 2150) and (MET 2130(C) or MEEM 2700(C) or ME 2700(C))

MET 3400 - Applied Fluid Mechanics

This course provides an introduction to the principles of fluid mechanics and their application to natural and engineering problems. Students are expected to have a good understanding of statics and dynamics. Development of engineering problem-solving skills will be emphasized.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MET 2130 or MEEM 2700 or ME 2700

MET 3451 - Machine Design II

This course extends the study of mechanical design begun in MET3242, Machine Design I and looks at more complex components and systems. Design projects are given special emphasis.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MET 3242

MET 3500 - Manufacturing Processes

Focuses on practical aspects of design and manufacturing. Covers fundamentals of manufacturing processes and includes a weekly lab to provide hands-on experience with manufacturing issues that influence component design.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): MSE 2100 and MET 2153

MET 3700 - Applied Thermodynamics

Engineering thermodynamics principles including work, heat and temperature, pure substances, closed and open systems, first and second laws of thermodynamics, and power and refrigeration cycles.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3400

MET 4210 - Applied Quality Techniques

Basic knowledge required to improve processes in the workplace. Includes the design of simple experiments, statistical process control, lean methodologies, and corrective and preventative action.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MA 2720(C) or MA 3710(C) or MA 2710(C)

MET 4300 - Applied Heat Transfer

Heat transfer principles including conduction, convection and radiation heat transfer mechanisms. Practical applications include thermal insulation, heat sink and heat exchanger design.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): (MET 3700 or MEEM 2201 or ME 2201) and MET 3400

MET 4355 - Industrial Digital Twin Systems

This course covers the principles and architecture of Digital Twins, emphasizing their application in manufacturing and mechatronics. Students will model, simulate, and optimize systems using real-time data, enhancing decision-making, and operational efficiency in smart industrial environments.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

MET 4360 - Thermal-Fluids Laboratory

This course provides hands-on experience with selected thermal-fluid laboratory experiments. Site/plant visits will be included for exposure to some of the practical aspects of the thermal-fluids area.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MET 3400 and (MET 3700 or MEEM 2201 or ME 2201) and MET 4300(C) and (MA 2710 or MA 2720 or MA 3710)

MET 4377 - Applied Fluid Power

An introduction to fluid power components and systems. The course includes component selection, circuit design, electrical interfaces, and system troubleshooting and maintenance. A laboratory exposes students to system hardware and circuit simulation techniques for mobile and industrial applications.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MET 2130 or MEEM 3201 or ME 3201

MET 4378 - Advanced Hydraulics: Electro-hydraulic Components & Systems

This course covers electro-hydraulic components including solenoid operated valves, proportional valves, and servo valves. Also covered are hydraulic systems including open-loop and closed-loop.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): MET 4377

MET 4390 - Internal Combustion Engines

An introduction to the basic principles and applications of internal combustion engines. The course covers design, development and testing of engine components and systems. A laboratory exposes students to current industry methods.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): MET 4300 or (MET 3700 and MET 4360(C))

MET 4460 - Product Design and Development

A treatment of design and development issues such as design for manufacturing, prototyping, industrial design, and customer needs. Presents integrated methodologies that examine marketing, manufacturing, and cross-functional teams. Includes concurrent engineering and projects utilizing CAD systems.
Credits: 2.0
Lec-Rec-Lab: (0-2-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MET 3451(C) and MET 3500(C)

MET 4510 - Lean Manufacturing and Production Planning

This course provides fundamental knowledge of continuous improvement methodologies as practiced in today's competitive manufacturing and business environments. It covers the basic concepts and key techniques involved in a lean implementation through hands-on activities, reading assignments, case studies, and discussions.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

MET 4550 - Computer Aided Manufacturing

Course is designed to apply techniques used in parametric modeling (CAD) and convert this information to all phases of production planning, machining, scheduling and quality control.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 2153 and MET 2400

MET 4575 - Senior Project I

Research and beginning design projects using computer-aided engineering methods, physical models, and/or prototypes. Evaluation and design optimization methods for efficient and cost-effective designs.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): MET 4460

MET 4585 - Facilities Layout and Safety Design

Examines the optimization concepts and safety topics necessary to design a low risk, high efficiency manufacturing facility layout. The focus will be on quantitative tools, flow analysis techniques, hazard recognition and resource selection.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

MET 4660 - CAE and FEA Methods

This course will introduce the use of the finite element method in stress analysis, heat transfer, and modal analysis. Emphasizes the modeling assumptions associated with using different elements and uses the computer to solve many different types of engineering problems.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 2400 and MET 3242(C)

MET 4675 - Senior Project II

Completion and evaluation of design projects using computer-aided engineering methods, physical models, and/or prototypes. Evaluation and design optimization methods for efficient and cost-effective designs.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): MET 4575

MET 4780 - Advanced Manufacturing

An introduction to advanced manufacturing processes, both traditional and nontraditional. Study of both theory and practice will be tied to laboratory experiments utilizing a spectrum of unique materials and methods.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): MET 3500

MET 4800 - Dynamics and Kinematics of Robotics Platforms

This course covers the dynamics and kinematics of rigid bodies as the foundation for analyzing the motion of robots. Robotic kinematics is reviewed by analyzing the motion of the robot. The dynamics is reviewed by analyzing the relation between the joint actuator torques and resulting motion.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): MET 2130 or MET 3130

MET 4802 - Vibrations of Mechanical Systems

This course deals with the modeling and analysis of mixed physical systems. Introduction to modeling and oscillatory response analysis for discrete and continuous mechanical and structural systems. Time and frequency domain analysis of linear system vibrations. Vibration of multi-degree-of-freedom systems. Free vibration eigenvalue problems.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MET 2130

MET 4996 - Special Topics in Mechanical Engineering Technology

Selected additional topics of interest in Mechanical Engineering Technology based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering Tech; Must be enrolled in one of the following Class(es): Senior

MET 4997 - Independent Study in Mechanical Engineering Technology

Independent study of an approved topic under the guidance of a Mechanical Engineering Technology faculty member. May be either an academic, design, or research problem/project.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering Tech; Must be enrolled in one of the following Class(es): Senior

MET 4998 - Undergraduate Research in Mechanical Engineering Technology

An undergraduate research experience in Mechanical Engineering Technology. Under the guidance of a Mechanical Engineering Technology faculty member, students work on a selected/approved research problem or work directly with faculty on active research projects/grants. May require more than one semester to complete.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Mechanical Engineering Tech; Must be enrolled in one of the following Class(es): Senior

MET 4999 - Professional Practice Seminar

Course designed to review and evaluate the program objectives linked with industrial partners and accreditation body. Focus given to preparing the student to take the certification exam.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior

Management

MGT 2000 - Team Dynamics and Decision Making

Develops individual and group problem-solving skills using active, hands-on learning. Emphasizes problem identification and problem solution under conditions of ambiguity and uncertainty. Stresses creativity, interpersonal skills and skill assessment, communication, group process and teamwork, and action planning.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

MGT 3000 - Organizational Behavior

Covers concepts of human relations and organizational behavior through the study of people's behavior at work. Develop understanding, attitudes, and skills leading to increased personal effectiveness.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

MGT 3100 - Leadership Development

Assesses students' current knowledge, abilities and values relevant to leadership and guides students in developing and implementing plans for new leadership abilities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

MGT 3650 - Intellectual Property Management

Covers principles of intellectual property laws, addressing managerial and policy issues in copyright, trademark, trade secret, and patents. Readings and discussions also cover how these property and legal systems impact the balance between property exclusivity, technological innovation and public access.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

MGT 3800 - Innovation & Entrepreneurship

Develops an entrepreneurial mindset and a personal toolkit of methods and practices that enables students to create and evaluate entrepreneurial opportunities, marshal resources, and engage in entrepreneurial teams driven by creativity, leadership, smart action, and innovation.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

MGT 4000 - Strategic Management

A capstone course focusing on managing from a strategic perspective for gaining advantages in competitive and dynamic environments, emphasizing understanding of industry, business models, growth strategies, and managing business portfolios. Integrates knowledge from finance, marketing, and organizational behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following College(s): College of Business; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): MIS 2000 and FIN 3000 and OSM 3000 and MGT 3000 and MKT 3000 and BUS 2300

MGT 4100 - International Management

Addresses the complexities and challenges faced by companies operating in an increasingly globalized world. Focuses on political, legal, ethical, cultural, economic issues, and on the entry, growth and knowledge management strategies of developed and developing country firms.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

MGT 4200 - Entrepreneurial Management

Draws upon the fundamental concepts of entrepreneurship covered in MGT3800 (Entrepreneurship) and enhances the understanding of these concepts from a strategic and entrepreneurial management point of view.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): MGT 3800

MGT 4300 - Developing Entrepreneurial Ventures

The concepts, skills, and attitudes critical for identifying and evaluating business opportunities and developing these opportunities into entrepreneurial ventures. Topics emphasize understanding of the discipline of innovation and method of launching new ventures.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MGT 3800

MGT 4500 - Managing Change in Organizations

Studies organizational theory with an emphasis on managing change in organizations. Examines forces for change in the external environment, methods for managing change (design and implementation), the impact of change on people, and leaders as agents of change. Case studies and student projects prepare the student to manage change in organizations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MGT 3000 or BA 5700

MGT 4600 - Management of Technology and Innovation

Introduces disruptive innovation concepts and provides occasions for their application to timely and relevant cases. Provides an understanding of technology management and innovation processes as they occur inside and outside of organizations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

MGT 4650 - Commercialization of Advanced Technologies

Frameworks, tools, and methods for commercializing novel technologies from lab bench to marketplace. Topics include opportunity evaluation, discovery-driven planning, legal and ethical implications. Provides a hands-on approach for students to commercialize technologies developed at research units.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MGT 4600

MGT 4700 - Human Resource Management

Examines methods that organizations use to meet organizational goals through influencing worker attitudes, behaviors, and performance. Topics include recruitment, selection, training, performance appraisal, and compensation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MGT 3000

MGT 4990 - Special Topics in Management

Examines additional management topics and issues in greater depth. A single offering of this course will concentrate on one or two topics which vary.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): MGT 3000

Management Information Systems

MIS 2000 - IS/IT Management

Focuses on the theory and application of the information-systems discipline within an organizational context, and identifies the roles of management, users, and information systems professionals. Covers the use of information systems and implications for decision support to improve business processes, and addresses the ethical, legal, and social issues of IT.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer

MIS 2100 - Introduction to Business and Analytics Programming

Develops business problem solving skills through the application of commonly used high-level business programming languages. Topics include foundational programming concepts practices and debugging and testing techniques. Introduces concepts for programming business analytics systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

MIS 2200 - Web Programming

Covers technologies, tools, and environments related to the development of mobile and web-enabled business solutions. Topics include the development environment for mobile and web-based solutions, key development technologies, desirable development practices, and design, programming, debugging and testing methods.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): MIS 2100 or CS 1122 or CS 1131

MIS 3000 - Business Process Management and Automation

Studies business decision management discipline using business rules, process models (e.g. flowcharts, unified modeling language, swim lanes), and information systems to improve efficiency and effectiveness. Emphasis on industry standards, automation tools, and business process management used to increase productivity.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MIS 2000

MIS 3100 - Business Database Modeling and Management

Emphasizes database principles that are constant across different database software products through concrete examples using a relational database management system. Provides a well-rounded business perspective about modeling, developing, utilizing, and managing organizational databases.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MIS 2000 or MIS 2100 or CS 1122 or CS 1131

MIS 3200 - Systems Analysis and Design

Provides an understanding of the IS development and modification process and the evaluation choices of a system development methodology. Emphasizes effective communication with users and team members and others associated with the development and maintenance of the information system. Stresses analysis and logical design of departmental-level information system.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MIS 2100 or CS 1122 or CS 1131

MIS 3500 - User-Centered Design

Studies user-centered design in development of effective interface solutions for business needs. Content may include input/output devices, user modeling, help and documentation, social issues, and usability evaluation. Emphasis on how interface design addresses human capabilities and capacities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): MIS 2000 or MIS 2100 or CS 1122 or CS 1131

MIS 4000 - AI and Emerging Technologies for Business

Focuses on understanding AI and IT for competitive advantage and as an agent of transformation. Topics include managing AI, IT infrastructure and architecture, facilitating information distribution throughout the enterprise, business applications for machine learning and artificial intelligence, and other emerging trends and technologies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MIS 2100 or CS 1122 or CS 1131

MIS 4100 - Business Analytics and Information Systems Projects

MIS and business analytics capstone course. Applies analytics and IS practices and artifacts as solutions to business problems using student-led project teams under faculty supervision. Students develop a working prototype of a business solution with analytics capabilities using good design and management practices.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): (MIS 2100 and MIS 3100 and MIS 3200) or (CS 2321 and CS 3141 and CS 3425) or (MIS 2100 and MIS 3100 and MA 3720)

MIS 4200 - Management of Cyber Security

Review of information systems security concepts and industry best practices. The subject matter is organized to provide students a foundation about cybersecurity principles, the business value of cybersecurity, and national and international policy and legal considerations related to cybersecurity.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MIS 2000 or MIS 2100 or CS 1111 or CS 1122 or CS 1131

MIS 4400 - Business Intelligence and Analytics

Focuses on generation and interpretation of business analytics relative to organizational decision making. Includes core skills necessary for constructing data retrieval queries in a relational database environment and processing data using appropriate programming languages. Introduces concepts related to data pipelining.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (MIS 2100 or CS 1122 or CS 1131) and (MIS 3100 or CS 3425)

MIS 4500 - Systems Design for Innovation and Entrepreneurship

This course is designed to support students who desire to design an IT software solution to commercialize. The course provides support for student entrepreneurs and innovators during various stages of the systems development life cycle, such as planning, requirements gathering, design and implementation.
Credits: 1.0; Repeatable to a Max of 6
Lec-Rec-Lab: (1-0-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): MIS 2000(C) or MIS 2100(C) or CS 1111(C) or CS 1122(C) or CS 1131(C) or SAT 1200(C)

MIS 4990 - Special Topics in Management Information Systems

Examines current IS/IT topics and issues in greater depth from a managerial perspective. A single offering of this course will concentrate on one or two topics, which will vary.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): MIS 2000 or MIS 2100 or CS 1122 or CS 1131

MKT - Marketing

MKT 3000 - Principles of Marketing

Emphasizes decisions made in developing both strategic and tactical marketing plans. Uses computer simulations, experiential learning assignments, and marketing plan development to demonstrate principles of market segmentation, product development, pricing, distribution planning, and promotion.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer

MKT 3200 - Consumer Behavior & Culture

Introduces students to models, theories, practices, and sociocultural issues pertinent to consumers' decision making and lifestyle choices. Discussions will be based on a variety of disciplines: psychology, sociology, economics, and anthropology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MKT 3000

MKT 3400 - Integrated Marketing Communications

Discusses how a variety of marketing communication methods, such as advertising, public relations, sales promotion, point-of-purchase, and direct marketing are developed, implemented, and evaluated in an integrative manner.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): BA 3800 or MKT 3000

MKT 3600 - Marketing Data Analytics

Focuses on data-driven consumer insights for marketing decision-making. Topics include scientific research methodology, survey research, social media data-analysis, multivariate data analysis, information visualization, and report writing and presentations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (MA 2710 or MA 2720 or MA 3710 or BUS 2100) and MKT 3000

MKT 4100 - Sales and Sales Technology

Focuses on sales force management and experience. Topics include the buying-selling process, sales data analysis, cutting-edge sales technologies, sales simulation and forecasting, negotiation, and sales strategies and tactics.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MKT 3000

MKT 4200 - B2B Marketing in a Digital Age

Emphasis is on B2B (Business to Business) marketing strategy. Topics include business marketing programs, buying center management, product offering using 3D printer, B2B case study, market trend analysis, and inter-firm relationship strategies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MKT 3000

MKT 4300 - Global Marketing

Discusses the critical elements of international marketing strategy: socio-politico-economic environment, global consumer culture, entry strategy, and global marketing mix. Utilizes cases and examples in order for students to better understand the globalized marketplace.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): MKT 3000

MKT 4500 - Digital Media Marketing

Introduces fundamentals of social media and e-commerce. Discussion also include search engine optimization, user-generated content, mobile applications, content strategies, social media campaigns, new media strategies, and future trends in digital marketing.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): MKT 3000

MKT 4700 - Marketing Strategy

Marketing capstone course. Discusses various aspects of creative and value-enhancing marketing strategies. Topics include branding, innovation, marketing research, marketing communication, services, consumer culture, corporate social responsibility, digital media marketing, and globalization.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): MKT 3200 and MKT 3600 and MKT 4300(C)

MKT 4990 - Special Topics in Marketing

Examines current issues in marketing. Topics are selected based on the interest to faculty and students
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required
Pre-Requisite(s): MKT 3000

Materials Science & Engineering

MSE 2100 - Introduction to Materials Science and Engineering

Introduction to the structure, processing, properties, and performance of engineering materials, including metals, polymers, glasses, ceramics, and composites. Topics include material selection in design, material processing in manufacturing, and structural material failure mechanisms.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): CH 1112 or CH 1122 or (CH 1150 and CH 1151) or (CH 1160 and CH 1161)

MSE 2110 - Introduction to Materials Science and Engineering II

Course is designed to address core competencies in the materials discipline. Topics include crystallography, structure description and quantification, crystal imperfections, phase diagrams, microstructure, and an introduction to the use of computing tools and software in materials science and engineering.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): (MSE 2100 or BE 2800) and (ENG 1100 or ENG 1101 or ENG 1101T)

MSE 3100 - Materials Processing I

Classical chemical thermodynamics is applied to single and multicomponent materials systems. Topics include heat and mass balance, enthalpy, entropy, free energy, chemical reactions and equilibria, mass action, solution thermodynamics, and phase diagram.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (MY 2100 or MSE 2100 or BE 2800) and MA 2160

MSE 3110 - Materials Processing II

A continuation of Materials Processing I, which introduces the fundamental theories and equations governing transport phenomena. Topics include fluid flow, heat flow, diffusion, and chemical kinetics. Discusses the relationships between these subjects and the thermodynamic concepts covered in Materials Processing I.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (MY 2110 or MSE 2110) and (MY 3100 or MSE 3100) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

MSE 3120 - Materials Characterization I

Fundamentals of microstructural and chemical characterization of materials. Examines the physical principles controlling the various basic characterization techniques. Topics include crystallography, optics, optical and electron microscopy, and diffraction. Laboratory focuses on proper operational principles of characterization equipment, which includes optical and other microscopy methods and various diffraction techniques.
Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Spring
Pre-Requisite(s): MSE 2110(C)

MSE 3130 - Materials Characterization II

Fundamentals and application of instrumental analysis in characterization of bulk materials and powders, and their internal phases and external surfaces. Demonstrates spectroscopic, thermal, and surface analysis techniques in identification of ceramics and polymers and their phases. Discusses the limitations and capabilities of elemental, chemical, and structural characterization methods combined with statistical analysis of data.
Credits: 4.0
Lec-Rec-Lab: (2-1-3)
Semesters Offered: Fall
Pre-Requisite(s): (MSE 2100 or BE 2800) and MSE 3120

MSE 3140 - Design of Microstructure

Relates thermodynamic and kinetic principles to phase transformations and microstructural evolution. Topics include nucleation, solidification, precipitation, recrystallization, and grain growth. Applications of these concepts (e.g., heat treatment, casting, deformation processing, powder processing, etc.) are presented to provide a bridge between phase transformation theory and industrial/laboratory practice.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MSE 2110 and MSE 3100 and MSE 3120 or (MSE 3121(C) and MSE 3122(C))

MSE 3160 - Electronic, Magnetic, Optical, and Thermal Properties of Materials

An introduction to electronic, optical, magnetic, and thermal properties of materials and their use in engineering applications. Topics include descriptions of the constitutive behavior that describes material response, and common techniques used for the fabrication of electronic, optical, and magnetic devices.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PH 2200

MSE 3170 - Material Selection in Mechanical Design

Selection of materials for engineering systems. Extraction of material selection indices from constitutive descriptions of mechanical and functional material behavior. Stress and strain at a point, and generalized Hooke's law. Strategies to minimize mass, cost, and environmental burden for a range of geometric design elements.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (MSE 2110 and MEEM 2110) or ENG 2120

MSE 3190 - Material Design

Integration of contemporary engineering design-modeling methodology with foundational structure-property-processing paradigm for materials design. Statistical analysis of laboratory measurements, formulating and testing of hypotheses, thermodynamic and kinetic modeling for material and process optimization, design of experiments.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Spring
Pre-Requisite(s): MSE 3100 and MSE 3110(C) and MSE 3120(C) or (MSE 3121(C) and MSE 3122(C)) and MSE 3130(C) or (MSE 3131(C) and MSE 3132(C)) and MSE 3140(C) and ENG 1102

MSE 3970 - Special Topics - Materials Science & Engineering

Special topics in Materials and Engineering.
Credits: variable to 4.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

MSE 4100 - Mechanical Behavior of Materials

An introduction to the deformation and fracture behavior of crystalline solids. Topics include elastic and plastic deformation, dislocation theory, strengthening mechanisms, fracture, and microstructure/mechanical property relationships.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): MSE 2110 and (MEEM 2150 or ENG 2120 or MSE 3170)

MSE 4110 - Introduction to Polymer Engineering

An Introductory study of polymeric materials and polymer engineering. This course covers the basics of polymer science, including molecular characteristics, synthesis, structure, and properties of polymers, with a strong emphasis on the thermodynamics of polymers. It also explores various mechanical and structural applications of polymers, focusing on real industry-driven challenges.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (MSE 2100 or BE 2800) and CH 1160

MSE 4130 - Materials Science & Engineering Senior Design Project I

Conducted in teams of students working with industrial partners. Open to all engineering majors interested in interdisciplinary senior design projects. Non-MSE majors must be senior project ready as defined by their major program and obtain permission of the MSE department.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MSE 3190

MSE 4140 - Materials Science & Engineering Senior Design Project II

Senior design project conducted in teams of students working with an industrial partner. Open to all engineering majors interested in interdisciplinary senior design projects. Senior project ready as defined by major substitutes for prerequisites.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MY 4920 or MSE 4130

MSE 4240 - Introduction to MEMS

Fundamentals of micromachining and microfabrication techniques, including planar thin-film process technologies, photolithographic techniques, deposition and etching techniques, and the other technologies that are central to MEMS fabrication.
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

MSE 4292 - Light and Photonic Materials

Material properties controlling light wave propagation in optical crystals and optical wave guides. Photonic crystals and photonic devices based on electrical, magnetic, and strain effects.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Physics, Applied Physics, Electrical Engineering, Materials Science and Engrg; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): PH 2200 or EE 2190 or EE 3140

MSE 4310 - Principles of Metal Casting

Principles of metal casting, including melting practice, casting design, mold design, heat transfer and solidification, fluid flow and gating design. Introduction to computer simulation techniques for mold filling, solidification, and development of residual stress. Structure-property relations in cast metals. Recycling and environmental issues of the cast metals industry.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MY 2100 or MSE 2100 or BE 2800

MSE 4320 - Corrosion and Environmental Effects

Mechanisms of corrosion processes, electrochemical and oxidation kinetics, and fundamentals of corrosion engineering.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MY 2100 or MSE 2100 or BE 2800

MSE 4325 - Fundamentals of Corrosion

Basic mechanisms of electrochemical processes and corrosion.
Credits: 1.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): CH 1150 and CH 1151

MSE 4330 - Advanced Physical Metallurgy

Advanced physical metallurgy principles are utilized to rationalize the process-structure-properties-performance relationships of the engineering alloys. Alloy systems covered include steels, cast irons, aluminum, magnesium, titanium and nickel alloys. Internationally recognized alloy designations, heat treatment standards, and characterization protocols are also presented.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MY 3300 or MSE 3140

MSE 4340 - Metal Additive Manufacturing

This course explores the fundamental principles and applications of metal additive manufacturing (AM) with a focus on understanding the complex relationships between processing conditions, build microstructure, and resulting build properties. Course is designed for senior undergraduate and graduate students in materials science and engineering.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): MSE 3110 and MSE 3140

MSE 4410 - Science of Ceramic Materials

The structure, defect chemistry, and properties of crystalline and amorphous ceramics. Utilization of these materials in a variety of applications such as electrolytes in fuel cells and as bioceramics are examined.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): MY 2100 or MSE 2100 or BE 2800

MSE 4430 - Composite Materials

Mechanistic aspects of property development in metal, ceramic, and polymeric composites. The role of composite architecture, processing, and microstructure on properties.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MY 2100 or MSE 2100 or BE 2800

MSE 4520 - Materials Forensics

Probes fundamental physical principles important to various characterization techniques used to understand crystal structure, microstructure, and substructure in materials. Application of x-ray, electrons, and light to unravel the structural mystery of materials and apply techniques to material failure analysis.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): (MSE 2100 or BE 2800) and MSE 2110

MSE 4530 - Scanning Electron Microscopy and X-ray Microanalysis

Topics include electron beam and image formation, beam- specimen interactions, and x-ray microanalysis. Course content is relevant to students of the physical sciences, engineering, and related disciplines. Includes a laboratory experience that provides hands-on practical training sufficient to enable independent use of the SEM.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

MSE 4540 - Computational Materials Science: Theory, Modeling, Simulation, and Practice

Theories of materials science from first principles to constitutive laws. Materials modeling and computer simulation at multiple length and time scales. Laboratory practice of various computational methods.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

MSE 4740 - Hydrometallurgy/Pyrometallurgy

Extraction and refining of metals and industrial chemicals from natural and recycled materials. Includes solution- chemistry processes (hydrometallurgy) and thermochemical processes (pyrometallurgy).
Credits: 4.0
Lec-Rec-Lab: (3-1-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): CH 1122 or (CH 1160 and CH 1161)

MSE 4777 - Distributed Additive Manufacturing Using Open-Source 3-D Printing

This course provides an overview of open-source hardware in theory and practice for an introduction to distributed additive manufacturing using open-source 3-D printing. Each student will build a customized RepRap and will learn all hardware and software for maintaining it.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following College(s): College of Engineering; Must be enrolled in one of the following Class(es): Junior, Senior

MSE 4970 - Special Topics - Materials Science & Engineering

Special topics in materials science and engineering.
Credits: variable to 4.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

MSE 4990 - Undergraduate Research

Undergraduate research in materials science and engineering. Independent research conducted under the guidance of a faculty member.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

Music

MUS 1000 - Music Appreciation

Overview of key composers, works, styles, and aesthetics in classical music, from Middle Ages plainchant to John Cage's experimental works in the 1940s-60s. Students will find compelling connections between music of the past and today's pop music.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer

MUS 1100 - Western Music Fundamentals

This course provides the means for gaining a foundational knowledge of Western musical theory principles. The course includes study in improvisation, aural skills, composition using industry standard notation software and functional harmony within the framework of Western tonal music. Prior experience reading notated music recommended.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

MUS 1140 - Popular Songwriting

This course is for students seeking to learn about popular music. The course will examine three aspects of music: the societal and cultural context that produces musical style, the technical construction of music itself, and the resultant ideas that music expresses. To gain a deep understanding of these, the student will listen to and analyze historical musical examples and engage in hands-on work, using software applications to compose and produce songs.
Credits: 3.0
Lec-Rec-Lab: (1-0-3)
Semesters Offered: Fall

MUS 1510 - Huskies Pep Band

The Huskies Pep Band is a 250-member student-led scramble band that supports the hockey, football, basketball, and volleyball programs at Tech. No audition required.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

MUS 1511 - Campus Concert Band

This wind ensemble performs band literature with moderate demands. Previous experience in a band or orchestra expected. No audition required.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring

MUS 1530 - Workshop Brass Band

This course is an ensemble that learns and performs classic jazz big band repertoire and New Orleans brass band music. The band learns anywhere from half to all of the music by ear without sheet music.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

MUS 1570 - Private Music Instruction

Professional private music instruction on brass, woodwind, string, piano, organ, guitar, harp, and voice. Guitars available for rental. School harp and pianos may be used. No string instruments available.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring, Summer

MUS 1580 - Group Voice

The fundamentals of speech and singing including information about the vocal instrument, the vocal process, vocal technique, and how to learn and perform simple solo songs.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

MUS 2000 - History of Classical Music

Developments in western classical music from the 1770s to 1970s in Europe, Russia, and America. Concentrates on music, style, aesthetics, culture, and biographies of major composers from the Classical, Romantic, and Twentieth-Century periods.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

MUS 2001 - Film Music

This course surveys the development of film music. Students will learn how music functions to support the aesthetic/narrative elements of the story. Students will learn skills to identify how music manipulates the listener and how composers shape that manipulation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand

MUS 2020 - History of Rock

Discussion and analysis of the most influential rock artists, songs, and albums from the 1920s to the 1990s. Genres include blues, rhythm & blues, big band, country & western, Chicago electric blues, rock & roll, folk, rock, hard rock, heavy metal, hair bands, punk, disco, new wave, synthpop, hip hop, grunge, and mainstream pop.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer

MUS 2030 - History of Jazz

Covers the musical, historical, and sociological elements of America's only original musical art form, jazz. Focuses on the major stylistic eras from 1900 to the present in addition to the major artists and their contributions. Emphasizes developing interactive, aural, and critical skills.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years

MUS 2040 - Music and Tradition

This course introduces the student to the diversity of traditional music from around the globe. Students will explore the universal importance of music, its place within a global community, and effects of technology on the cross pollination of musical styles.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

MUS 2101 - Western Music Theory I

This course includes study in improvisation, part writing, counterpoint, aural skills, composition using industry standard notation software and functional harmony within the framework of Western tonal music.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): FA 2501 or MUS 1100

MUS 2102 - Western Music Theory II

This course includes study in improvisation, counterpoint, aural skills, and harmony within the framework of Western tonal music and musical style, form and composition in music from diverse musical traditions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): FA 2500 or MUS 2101

MUS 2103 - Jazz Theory and Aural Skills

This course covers jazz harmony, chord/scale theory, ear training, spelling chords, writing original chord progressions, analyzing jazz solo transcriptions, and analyzing jazz standards.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): MUS 1100 or FA 2501

MUS 2530 - Research and Development Jazz Band

The Research and Development Jazz Band is for instrumentalists wishing to learn the fundamentals of jazz improvisation and the nuances of the jazz idiom. Repertoire includes swing, jazz, rock, Latin, ballads, fusion, and other contemporary jazz styles. Public performances are given on campus and in the surrounding area. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

MUS 2580 - Concert Choir

A select ensemble made up of student and community singers studying and performing traditional choral literature ranging from chant to avant-garde compositions. Activities include campus and community performances and occasional international tours. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

MUS 3020 - Beatles and Beach Boys

Critical analysis of the best songs and albums of The Beatles and The Beach Boys from the period 1965-1968, including discussion of their social and historical impact.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Summer

MUS 3101 - Music Composition I

This course is a study in the art of acoustic instrumental, vocal and MIDI composition. Students will study music of contemporary composers and create compositions for performance.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (FA 2500 or MUS 2101) and (FA 3530 or MUS 2102(C))

MUS 3102 - Music Composition II

This course is a continuation of Music Composition I. Students expand their skills to include composition for media including, film, television, and digital arts. Students will apply their skills to create fully realized live performances of their compositions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (FA 2500 or MUS 2101) and (FA 3530 or MUS 2102) and (FA 3112 or MUS 3101)

MUS 3130 - Jazz Improvisation

Students learn to improvise in a variety of keys and styles. Emphasis will be placed on learning the idiomatic use of the major scale, associated modes, and the blues. Students will learn a series of blues tunes by ear, in different keys, and will gain tools for navigating different types of blues (traditional, jazz blues, bird blues, etc.). Students will arpeggiate chords of the blues learning to utilize chord tone enclosures. Students will explore the styles of swing, bebop, blues, Latin and rock/funk. Emphasis on the II-V-I progression in major and minor keys.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): MUS 2103

MUS 3210 - Electronic Music: History and Practice

Introduction to the history of, and practices of making, electronic music. This course presents a survey of the most significant artists in the history of electronic music. Provides hands-on training and projects in electronic music production.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (FA 1601 and FA 1602) or (SND 1101 and SND 1102)

MUS 3500 - Keweenaw Symphony Orchestra

The KSO is a college-community orchestra comprising Tech students, Tech faculty, and community musicians. The ensemble performs the great orchestra, opera, and ballet masterworks. The orchestra presents 4-5 yearly concerts, including periodic concert tours. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

MUS 3510 - Superior Wind Symphony

The university's premiere concert wind ensemble, performing advanced wind band literature form the 1600s to the present. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

MUS 3530 - Jazz Lab Band

A select ensemble of approximately twenty instrumentalists studying jazz improvisation and performing literature for the jazz ensemble. Repertoire includes swing, jazz-rock, ballads, fusion, and experimental compositions. Activities include performances at festivals, concerts, and dances, and a spring-break tour. Course work includes topics in jazz history, music theory, and improvisation. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

MUS 3580 - Chamber Choir

Participation in the Chamber Choir provides opportunities for students to explore and perform music written for small choir. Repertoire from varied styles and time periods (from antiquity to the present) will be prepared and presented in formal and informal performance settings. Audition required.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring

MUS 3700 - Visual & Performing Arts Tour

Students participating in fine arts performance tours taking place outside of regular academic terms are eligible to receive credit based on the time span of the tour and the nature of the itinerary. Requires active membership in the touring group or permission of director.
Credits: variable to 3.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: On Demand
Restrictions: Permission of instructor required

MUS 3850 - Special Topics: Music

Tutorial, seminar, or class study of a topic of special interest and importance in visual and performing arts.
Credits: variable to 3.0; May be repeated
Semesters Offered: On Demand

MUS 4100 - Conducting and Interpretation

A capstone seminar course that examines philosophies of music interpretation, analyzing music scores, comparing and contrasting recorded music, and defining musicianship. Students will learn basic conducting techniques and be given the opportunity to conduct live ensemble rehearsals.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): FA 2500 or FA 2501 or MUS 1100 or MUS 2101

MUS 4130 - Jazz Arranging

Explores elements of jazz arranging and composition while developing creative ideas in the individual musician. Emphasis on learning to arrange for jazz combo and traditional big band. Includes developing the shape concept of triad use, 4-part and 5-part chord voicing, construction of an arrangement, and competence with FINALE notational software.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): MUS 2103

MUS 4510 - Chamber Music Ensemble

For students interested in the study and performance of instrumental chamber music. Small ensembles meet regularly under faculty supervision.
Credits: 1.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-1)
Semesters Offered: On Demand
Restrictions: Permission of instructor required

MUS 4530 - Jazz Combo

Jazz combos (e.g., Jaztec, Salsa Norte) are select small groups of musicians studying jazz improvisation and performing literature for the small jazz ensemble. Focuses on developing individual improvisational techniques, personal style, and unique original arrangements. Repertoire includes swing, jazz-rock, ballads, fusion, and experimental techniques. Activities can include performances and tours.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

MUS 4800 - Independent Study: Music

Independent research directed by Visual and Performing Arts faculty. Projects focus on topics in music. Requires a written proposal setting out goals, plans for final project, and the resources required to complete the project.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

MUS 4900 - Visual and Performing Arts Final Project

Capstone course extending the student's knowledge and skill in a chosen fine arts discipline through independent research or other focused creative activity. A detailed proposal of the student's final project must be approved in writing by a Visual and Performing Arts faculty advisor before the student enrolls in FA4970.
Credits: variable to 3.0
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

Nursing

NUR 1100 - Introduction to Nursing

This course introduces students to the foundation of professional nursing practice. Students will examine the theoretical and philosophical underpinnings of the profession, clinical judgment, career paths, and essential skills for academic and professional success. An introduction to the Nursing program philosophy is presented.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Pre-Nursing

NUR 2000 - Pharmacology

Introduction to the basic concepts of pharmacology and their relationships to health care. Focuses on the major drug classifications, principles of drug actions/interactions, application of specific drugs in the treatment of disease, normal and abnormal responses to drug therapy, dosage calculations, and appropriate nursing actions to achieve desired outcomes of drug therapy. The nurse's role and responsibilities in clinical pharmacology are examined. Prerequisites of CH1000 and BL2020 and BL2021 with grades of C or better is required.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Nursing
Pre-Requisite(s): (CH 1000 or CH 1150) and BL 2020 and BL 2021

NUR 2020 - Health Assessment and Interview

An introduction to the skills used in data collection and physical assessment, including interviewing, communication, comprehensive history taking, physical assessment, and formulating a nursing diagnosis. The course draws on the nursing process in assessing the health of individuals across the lifespan. Prerequisites of BL1710 and BL2020 and BL2021 with grades of C or better is required.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Nursing
Pre-Requisite(s): BL 1710 and BL 2020 and BL 2021

NUR 2030 - Dosage Calculations

Introduces nursing students to the concepts, terminology, equipment, and math calculations necessary for safe medication administration in the clinical setting. Topics include systems of measurements, equivalents and conversions, selected abbreviations, and computation of medication dosages. Prerequisites of MA1020 or MA1031 or MA1032 or MA1135 or MA1160 or MA1161 with grades of C or better is required.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Nursing
Co-Requisite(s): NUR 2040
Pre-Requisite(s): MA 1020 or MA 1031 or MA 1032 or MA 1135 or MA 1160 or MA 1161 or MA 2160 or MA 2720 or MA 2710

NUR 2040 - Fundamentals of Nursing Practice

Introduces the basic concepts of the practice of nursing. Focuses on the skills required to care for adult clients in structured, non-emergent environments using demonstration and simulated practice. The role of the nurse as provider of care is discussed. Students are introduced to the clinical setting where the nursing process is used as the basis for decision making and nursing behaviors. Communication skills and nurse-client relationships are developed. Laboratory settings include campus lab, senior living complex, community events, schools, and in-patient units. Prerequisite of BL2020 and BL2021 with grades of C or better is required.
Credits: 6.0
Lec-Rec-Lab: (3-0-9)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Nursing
Co-Requisite(s): NUR 2000, NUR 2020
Pre-Requisite(s): BL 2020 and BL 2021

NUR 2050 - Application of Nursing Practice

Provides students with the opportunity to use previously attained nursing skills in caring for an adult client in a non-emergent environment. Students apply the skills necessary to demonstrate the role of the nurse as provider of care. Prerequisites of NUR2020 and NUR2040 with grades of B or better is required.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Nursing
Co-Requisite(s): NUR 2060
Pre-Requisite(s): NUR 2020 and NUR 2040

NUR 2060 - Pathophysiology

Introduces concepts and diseases common to the general practice of health care. Studies on how normal physiological processes are altered by disease. Core content provides understanding of the mechanisms and principles of disruptions of health. Theories related to pathogenesis, etiology, and clinical manifestations are used to study common diseases with an emphasis on clinical correlations. Prerequisites of CH1000 or (CH1150 and CH1151) and BL2020 and BL2021 with grades of C or better are required.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Nursing
Pre-Requisite(s): CH 1000 or (CH 1150 and CH 1151) and BL 2020 and BL 2021

NUR 3000 - Psychiatric Mental Health Nursing

This course introduces the student to the theoretical and practical foundation for application of the nursing process in addressing patient mental health. Theories, concepts, and interventions related to mental health and illness are presented. The course develops nursing assessment and intervention strategies, explores patient/consumer rights and legal issues; political, social, and cultural factors which effect mental health and mental health treatment; and individual and group dynamics in acute and community settings. Prerequisites of NUR2000 and NUR2020 and NUR2040 with grades of B or better are required.
Credits: 6.0
Lec-Rec-Lab: (4-0-6)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Nursing
Co-Requisite(s): NUR 2050, NUR 2060
Pre-Requisite(s): NUR 2000 and NUR 2020 and NUR 2040

NUR 3120 - Nursing Theory

Designed to enable the students to examine nursing from a historical as well as present-day perspective. Examines the organizing framework of the nursing program philosophy and the concepts of nursing, person, environment, and health that underscore nursing's metaparadigm. Nursing conceptual models and theories and their relationship to research and professional nursing practice are discussed. Prerequisites of UN1015 (grade of C or better required) and NUR2040 (grade of B or better required).
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015 and NUR 2040

NUR 3180 - Nursing Research/Statistics

Introduces the concepts of the research process including research methodologies, measurement, and analysis of research data that provides students with a basis to interpret and evaluate research and its application to practice. Emphasis is placed on students becoming knowledgeable consumers of research. Prerequisites of (MA1020 or MA1031 or MA1032 or MA1160 or MA1161 or MA1135 - grade of C or better required) and NUR3120 (grade of B or better required).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): (MA 1020 or MA 1031 or MA 1032 or MA 1160 or MA 1161 or MA 1135) and NUR 3120

NUR 3200 - Maternal - Child Nursing

Theoretical and clinical foundations are applied using the nursing process in caring for children and child-bearing families throughout the lifespan including women's health. Emphasizes the promotion, maintenance, and restoration of health of the primary family unit, including the concepts of changing relationships and the impact of the community and culture on growing families. Physiological and psychosocial adaptation of the child and family during normal and complex health needs are addressed. Prerequisites of NUR3000 (grade of B or better required) and PSY2300 (grade of C or better required).
Credits: 9.0
Lec-Rec-Lab: (6-0-9)
Semesters Offered: Fall
Co-Requisite(s): NUR 3240
Pre-Requisite(s): NUR 3000 and PSY 2300

NUR 3240 - Adult Medical Surgical Nursing I

Expands theoretical foundation for application of the nursing process throughout the adult lifespan. Scientific principles in health promotion and management of care are applied with adults experiencing health deficits. Critical judgments in planning and implementing nursing interventions are integrated in caring for adults in various health care environments. Prerequisite of NUR3000 (grade of B or better required).
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Co-Requisite(s): NUR 3200
Pre-Requisite(s): NUR 3000

NUR 3280 - Adult Medical Surgical Nursing II

Further expands the theoretical foundation of the nursing process throughout the adult lifespan. Scientific principles in health promotion and management of care are applied with adults experiencing health deficits. Critical judgments in planning and implementing nursing interventions are integrated in caring for adults in various health care environments. Prerequisite of NUR3200 and NUR3240 with grades of B or better are required.
Credits: 10.0
Lec-Rec-Lab: (6-0-12)
Semesters Offered: Spring
Co-Requisite(s): NUR 3180
Pre-Requisite(s): NUR 3200 and NUR 3240

NUR 4000 - Acute and Urgent Clinical Nursing

Summer course broadens the clinical professional nursing experience and prepares students for final year of the BSN curriculum. The primary focus is an expanded opportunity for achieving clinical competencies in acute and urgent care settings within the regional medical center. A total of 126 contact hours is required with time scheduled for pre-clinical activities, hospital orientation, day and evening shift rotations in various acute and urgent care settings and compiling final case presentations to share individual experiences with others. Travel associated with scheduled clinical experiences at a regional medical center is expected. Prerequisites of NUR3180 and NUR3280 (grades of B or better required) and PSY2300 (grade of C or better required).
Credits: 3.0
Lec-Rec-Lab: (0-0-9)
Semesters Offered: Summer
Pre-Requisite(s): NUR 3180 and NUR 3280 and PSY 2300

NUR 4020 - Nursing Management/Leadership

Synthesizes previously acquired theoretical and clinical foundation for application of the nursing process as it relates to management in professional nursing. Further development of entry-level leadership and management skills as provider of care and manager of clients with complex multidimensional health problems. Students refine their autonomy, accountability, collaboration, and caring communication in managing groups of clients in a variety of settings. Prerequisites of NUR3120 and NUR3180 and NUR4000 with grades of B or better are required.
Credits: 6.0
Lec-Rec-Lab: (2-0-12)
Semesters Offered: Fall
Co-Requisite(s): NUR 4040
Pre-Requisite(s): NUR 3120 and NUR 3180 and NUR 4000

NUR 4040 - Issues in Professional Nursing

Explores the issues and trends in nursing as a profession. Social, economic, political, and educational forces influencing nursing and health care in the United States are discussed. The professional, legal, and ethical responsibilities of the nurse, and the career opportunities available within the profession, are examined. Health care delivery systems, entry into practice, and professional organizations are discussed. Investigates role socialization from student to professional nurse. Taken in the final year of the Nursing program. Prerequisites of NUR3120 and NUR3180 and NUR4000 with grades of B or better are required.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall
Pre-Requisite(s): NUR 3120 and NUR 3180 and NUR 4000

NUR 4060 - Community Nursing

Focuses on the theoretical and clinical foundation for application of the nursing process in caring for individuals, families, groups, and the community as a client. Emphasis on disease prevention, health promotion, health maintenance, health education, and coordination of care. Content includes application of public health nursing principles, epidemiological investigation, knowledge of rural environments, supervision and leadership in promoting desired health evaluation, and outcomes in community and home environments. Explores the role of the nurse as teacher, collaborator, advocate, and direct care provider. Prerequisite of NUR4040 with grade of B or better required.
Credits: 6.0
Lec-Rec-Lab: (2-0-12)
Semesters Offered: Spring
Co-Requisite(s): NUR 4080
Pre-Requisite(s): NUR 4040

NUR 4080 - Nursing Capstone

Capstone experience in which students synthesize evidence-based practice and theoretical and research-based knowledge to develop a senior project using critical thinking skills, clinical judgment, and independent decision-making. Students demonstrate proficiency in meeting the BSN terminal objectives and accreditation outcome criteria.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring
Co-Requisite(s): NUR 4060

Operations & Supply Chain Management

OSM 3000 - Operations and Supply Chain Management

Fundamental principles of operations and supply chain management; includes strategic importance and relevant interrelated concepts and tools in product/process design, work systems, forecasting, inventory and materials management, just-in-time, scheduling, and capacity management.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (MA 1135 or MA 1160 or MA 1161 or MA 1121) and (MA 2710 or MA 2720 or MA 3710 or MA 3720 or EET 2010 or BUS 2100 or CEE 3710)

OSM 3150 - Introduction to Supply Chain Management

An introduction to supply chain management to gain a perspective on integration and coordination issues. Topics include strategy, network design, facility design, sourcing, logistics, forecasting, inventory, relationship management, and global and sustainable supply chain management.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): OSM 3000(C)

OSM 3600 - Procurement and Supply Management

Addresses processes that facilitate the management of value- added transactions and relationships between supplier and customer organizations. The course examines the management of the business purchasing function, including supplier selection and development, cost management, performance measures, buyer-supplier relationships, and negotiation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

OSM 4300 - Project Management

The various stages in a project life cycle will be covered and include initiation, planning, execution, and closeout. Basic tools such as the Project Charter, Network Diagrams Gantt, and budgeting will be covered. Basics of MS Project are included.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): BUS 2100 or CEE 3710 or MA 2720 or MA 3710 or EE 3180 or BE 2110 or MA 2710 or PSY 2720

OSM 4350 - Advanced Project Management

A project-oriented business development class focused on real-life and advanced applications of project management techniques. Students participate in a competition, prepare for the PMI CAPM exam, and may sit for the exam to obtain certification.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): OSM 3200 or ENG 4300 or OSM 4300

OSM 4650 - Six Sigma Fundamentals

Course is framed in context of six sigma methodology. Topics include principles of Shewhart, Deming, Taguchi; meaning of quality; control charts for variables, individuals, and attributes; process capability analysis; variation of assemblies; and computer-based workshops.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): MA 2710 or MA 2720 or MA 3710 or MA 3720 or BUS 2100 or CE 3710 or CEE 3710

OSM 4700 - Logistics and Transportation Management

Focuses on the transportation and distribution services that support demand fulfillment from the receipt of customer orders to order fulfillment. Topics include customer service, order fulfillment, inventory, transportation costs and modes, facility design and operation, carrier selection, and negotiation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (MA 2710 or MA 2720 or MA 3710 or CE 3710 or CEE 3710) and (MA 1135 or MA 1160 or MA 1161 or MA 1121)

OSM 4990 - Special Topics in Supply Chain and Operations Management

Examines additional supply chain and/or operations management topics and issues in greater depth. A single offering of this course will concentrate on one or two topics, which vary.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): OSM 3000

Physical Education

PE 1000 - Fitness Foundations

Students will be introduced to practices and physical activities that they can incorporate into their daily life to sustain their healthy body and mind.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1010 - Active Michigan Tech

Course will focus on developing student well-being through self-guided learning. Topics of interest will include mindfulness, nutrition, sleep, and movement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

PE 1028 - Ski Patrol - Outdoor Emergency Transport

National Ski Patrol training involving fitness, skiing proficiency, toboggan handling, and lift evacuation. Requires payment of dues to become a member of National Ski Patrol. Participation in this course requires PSIA Level skiing/boarding skill. Students must provide own equipment Some rentals available at Mont Ripley. Skills demonstration required for continued enrollment.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring
Restrictions: Permission of instructor and department required

PE 1101 - Team Sports

Students will demonstrate fundamental skills, knowledge of rules, strategies, and safety of the following team sports necessary for participation: flag football, softball, volleyball, soccer, basketball, and floor hockey. Students should bring a glove for softball.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1102 - Hockey

Individual skills, team techniques, rules, and strategies. Requires basic hockey equipment of helmet with face mask, shoulder pads, hockey pants, shin pads, elbow pads, hockey gloves, skates, supporter, jersey, hockey socks, hockey stick. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1103 - Bait and Fly Casting

Bait and fly casting skills. Each student must have a valid current year Michigan fishing license. Trout stamp is optional. Equipment is available if needed. Requires some additional hours outside of class.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: On Demand

PE 1105 - Bowling

Students will learn skills, rules, and scoring of bowling. Including skills and strategy involved in tournament play.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1106 - Golf

Intermediate to advanced individual instruction in golf techniques, terms, courtesies, and tournament regulations. Equipment needed; some rental clubs available.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1108 - Broomball

Students will learn the rules, strategy, and safety needed to compete in broomball. Offensive and defensive zone coverages and individual skills are stressed. Team play with officials. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1109 - Aikido

Aikido is a modern Japanese martial arts discipline that uses martial arts training as a means of character development.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1113 - Disc Sports

Students will demonstrate fundamental skills, knowledge of rules, strategies, and safety disc golf, frisbockey, and ultimate frisbee. Equipment provided.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1115 - Beginning Swimming

Non-swimmers learn to have no fear of water, to float, and to swim the four fundamental strokes.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 1116 - Intermediate Swimming

Students learn to swim four basic strokes with proficiency. Requires ability to swim the length of pool comfortably.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1117 - Fitness Swimming

Practices the basic strokes; introduces knowledge in creating workouts to encourage swimming as a lifetime fitness activity.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1118 - Weight/Fitness Training

This course is designed to introduce students to a variety of weight and fitness activities to improve their well- being. Activities will include using aerobic and strength training machines. Students will learn basic concepts on how to safely and properly use the fitness center equipment.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1119 - Conditioning

Students will demonstrate the fundamental knowledge and skills of conditioning, leading to continued enjoyment and participation as a lifelong activity.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1120 - Beginning Alpine Skiing (Downhill)

Beginning skills of alpine skiing techniques taught, evaluated, and recommendations made for improvement. Exclusively for beginners and never evers, students with more advanced should not enroll. Must arrange own transportation to Mont Ripley. Students must also provide equipment, including a helmet, or pre-arrange, for a fee, for daily/seasonal rental through Mont Ripley. Some online participation is necessary. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1121 - Beginning Snowboarding

Beginning skills of snowboarding techniques are taught and evaluated, and recommendations are made for improvement. Exclusively for beginners and never evers, students with more advanced skills should not enroll. Students must arrange own transportation to Mont Ripley. Students must also provide equipment, including a helmet, or pre-arrange for a fee for daily/seasonal rental through Mont Ripley. Some online participation is necessary. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1123 - Telemark Skiing

The fundamentals of Telemark skiing techniques will be taught and evaluated, and recommendations for improvement will be provided. While some prior experience in alpine or Nordic skiing is preferred, it is not required. Students must arrange their own transportation and provide their own Telemark ski equipment including a helmet. A limited number of Tele rentals are available at Mont Ripley for a fee, which should be arranged in advance. Some online participation is necessary.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1124 - Intermediate Alpine Skiing (Downhill)

This course focuses on teaching and evaluating intermediate to advanced alpine skiing techniques, with recommendations for improvement. Students will explore a variety of terrain beyond the beginner level. Students must provide transportation to Mont Ripley. Students must provide equipment, including a helmet or pre-arrange for a fee for daily/seasonal rental through Mont Ripley. Some online participation is necessary. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1125 - Intermediate Snowboarding

This course focuses on teaching and evaluating intermediate to advanced snowboarding techniques, with recommendations for improvement. Students will explore a variety of terrain beyond the beginner level. Students must provide transportation to Mont Ripley. Students must provide equipment, including a helmet, or pre-arrange for a fee for daily/seasonal rental through Mont Ripley. Some online participation is necessary. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1126 - Advanced Skiing

Advanced skills of skiing techniques taught, evaluated, and recommendations made for improvement. Note that steep, narrow, and ungroomed terrain may present challenges. Multiple years of previous skiing are suggested. Students must provide transportation to Mont Ripley. Students must provide equipment, including a helmet, or pre-arrange for a fee for daily/seasonal rental through Mont Ripley. Some online participation is necessary. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1127 - Advanced Snowboarding

Advanced skills of skiing techniques taught, evaluated, and recommendations made for improvement. Note that steep, narrow, and ungroomed terrain may present challenges. Multiple years of previous skiing are suggested. Students must provide transportation to Mont Ripley. Students must provide equipment, including a helmet, or pre-arrange for daily/seasonal rental through Mont Ripley. Some online participation is necessary.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1128 - Alpine Skiing Fusion

Self-paced class requires student to submit electronic tracings that document activity on a weekly basis. Electronic app used to uniquely document runs, vertical feet skied and time descending on hill. Total of 28 hours moving on the hill is required. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1129 - Snowboard Fusion

Self-paced class requires student to submit electronic tracings that document activity on weekly basis. Electronic app used to uniquely document runs, vertical feet boarded and time descending on hill. Total of 14 hours moving on the hill is required. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1135 - Cross Country Skiing

Develop the skills for touring/recreational cross-country skiing. Own equipment is recommended; rental equipment available. One additional hour by arrangement.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring

PE 1138 - Racquet Sports

Students will demonstrate fundamental skills, knowledge of rules, strategies, and safety of table tennis, racquetball, and badminton. Equipment provided.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1140 - Tennis

Fundamentals of the game, rules, and etiquette of tennis. Non-marking court shoes must be worn. Tennis balls and racquets provided. Recommend use of personal racquet.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1142 - Introduction to Brazilian Jiu Jitsu

This course introduces students to the fundamentals of Brazilian Jiu Jitsu. This is a martial art, combat sport and self defense system that focuses on grappling and ground fighting.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1145 - Rifle Marksmanship

Introduces students to marksmanship skills in small bore target shooting. Increases students' knowledge of firearm safety, international target shooting styles, and shooting sports competition methods and techniques for rifle target shooting.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1146 - Billiards

Introduction to the etiquette, rules, and recreational value of pocket billiards.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1148 - Skating

Fundamental skills of ice skating, including proper stroking forward and backward, edges, crossovers, stops, and other basic skills. Requires own skates and helmets.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1150 - Lifetime Activities

This class will introduce students to a variety of recreational activities often used in a social/leisure setting (i.e. ladder golf, disc golf, croquet, etc.).
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Summer

PE 1152 - Social Dance

Fundamentals of social dance, providing the basic skills, concepts of movement, style, and fundamental step patterns. Emphasis on the development of fundamental dance skills and practice in utilizing dance techniques.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1153 - Zumba

Zumba is a Latin-inspired, dance-fitness class that incorporates Latin/International music and dance movements, creating a dynamic, exciting, and effective fitness program. The Zumba program integrates basic principles of aerobic, interval, and resistance training to improve cardiovascular health while increasing muscular fitness and flexibility.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1154 - Aerobics

Improvement of cardiovascular fitness, strength, coordination, and body mechanics through exercise.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1155 - Road Biking

Learn to be comfortable and confident while riding a regular road bike. Covers basic maintenance repair procedures. Requires own equipment and supplies, including a bike helmet.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PE 1156 - Mountain Biking

Learn to be comfortable and confident while riding a mountain bike off-road. Covers basic maintenance repair procedures. Requires own equipment and supplies as well as a biking helmet.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer

PE 1165 - Rowing

This course will teach rowing techniques using indoor rowing machines (ergometers). Classes will consist of learning the parts of the stroke and rowing as a crew. Students will also experience and develop rowing-based workouts designed to target endurance and strength.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1167 - Beginning Yoga

Learn the basics or compliment previous experience while improving flexibility, balance and concentration. Improve focus. Relax mentally and physically.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1169 - Indoor Cycling

High energy, group cycling class utilizing music to motivate and encourage active engagement throughout the course session. Students will be able to identify basic steps used to ensure proper and safe bike set, recognize and safely demonstrate core moves, and apply rate of perceived exertion in specific work zones to achieve fitness goals.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1170 - TaeKwonDo

Introduction to the basic kicking, blocking, punching, joint locking, and self-defense techniques of TaeKwonDo and Hapkido. Emphasizes improvement of flexibility, skills and strategies.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1175 - Hiking

Fundamental knowledge and skills specific to hiking will be covered. Appropriate clothing and footwear for hiking is recommended. Course meets on weekends (usually Saturdays). Due to class structure, students must attend all classes - No Exceptions.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Summer

PE 1177 - Fundamentals of Laser Tag

Tactical laser tag.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 1205 - Special Topics

Unconventional activity courses that address varying and changing student interests. Topics vary.
Credits: 0.5; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 1209 - Intermediate Aikido

This course is designed to be a continuation of Aikido.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: On Demand

PE 1210 - Special Topics

Unconventional activity courses that address varying and changing student interests. Topics vary.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 1220 - Introduction to Canoeing

Fundamental knowledge and skills of canoeing leading to continued enjoyment and participant as a lifelong activity. Students will practice/learn the basic strokes, and be knowledgeable about proper care and use of equipment related to canoeing.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall

PE 1225 - Indoor Rock Climbing

Fundamental knowledge and skills of rock climbing leading to continued enjoyment and participation as a lifelong activity. Students will practice/learn the basic terminology, knots, equipment, policies and procedures, and be knowledgeable in the proper care and use of equipment related to climbing, as well as safety concerns when climbing.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1230 - Introduction to Kayaking

Fundamental knowledge and skills of kayaking leading to continued enjoyment and participation as a lifelong activity. Students will learn/practice basic strokes, and be knowledgeable in the proper care and uses of equipment related to kayaking, as well as safety concerns when kayaking.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall

PE 1235 - Introduction to Log Rolling

Fundamental knowledge and skills of log rolling as a sport, the different steps including front, back, and skip steps, and techniques of getting on the log. Log rolling is a different style of workout that works on balance, core, and endurance. History of Log Rolling and current competitive opportunities will be covered.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 1240 - Snowshoeing

Fundamental knowledge and skills of snowshoeing leading to continued enjoyment and participation as a lifelong activity. Students will learn about equipment, proper care and storage of equipment, and basic concepts of snowshoeing.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Spring

PE 1242 - Brazilian Jiu Jitsu II

Advanced fundamentals of Brazilian Jiu Jitsu, which is a martial art, combat sport and self defense system that focuses on grappling and ground fighting.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1245 - Wilderness First Responder

The definitive wilderness course in medical training, leadership, and critical thinking for outdoor, low-resource, and remote professionals and leaders. This course is the ideal medical training for leaders in remote areas, as well as general recreation users in remote in wild settings.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-4)
Semesters Offered: On Demand

PE 1250 - Paintball

Students will be exposed to the sport of paintball for enjoyment and physical exercise in a relaxed outdoor setting.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1267 - Intermediate Yoga

Combined ancient Hatha yoga poses with modern fitness movement to create a total mind/body workout for all fitness levels. Improve breathing and oxygen intake.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1270 - Cardio TaeKwonDo

Improvement of kicking, blocking, punching, joint locking, and self-defense techniques. Emphasizes improvement of skills and strategies involved in TaeKwonDo.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1277 - Strategies of Laser Tag

Strategies of laser tag.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1330 - Club Sports

Club sport participation based on student interest. Group must be on the approved list of sports and all membership requirements must be up to date. Students enrolling in this course must participate in 14 hours of activity during the semester. Participation is tracked by instructor of record. No retroactive credit will be awarded for involvement in club sport activity.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

PE 1342 - Intro to Kickboxing

Students will demonstrate fundamental knowledge and skills specific for participation and enjoyment as a lifelong recreational activity. Learn the basics in the sport of kickboxing. Kickboxing is a martial art, combat sport, and a self-defense system that focuses on using footwork, a variety of punches and kicking techniques.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1367 - Mindful Yoga

A restorative yoga class that is very gentle and has an emphasis on meditations/mindfulness.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 1425 - Intramurals

Intramural activity that addresses varying and changing student interests. Sports vary. Students must be a member of IMleagues.com/MTU. Students enrolling in the course must participate in 14 games/contests during the portion of the semester that the course is offered to receive a passing grade. Participation is tracked via IMleagues.com/MTU. No retroactive credit will be awarded for involvement in intramural activities.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

PE 1430 - Club Sports Leadership

Leadership in club sport participation based on student interests. Students enrolling in this course must hold a position of leadership within the club sport. Group must be on approved list of sports and all membership requirements up to date. Students must participate in 14 hours of leadership activity during the semester. Participation is tracked by instructor of record. No retroactive credit will be awarded for involvement in club sport activity.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

PE 1435 - Self Defense for Women

The Rape Aggression Defense System is a program of realistic, self-defense tactics and techniques. The R.A.D. System is a comprehensive course for women that begins with awareness, prevention, risk reduction and avoidance, while progressing on to the basics of hands-on defense training. R.A.D. is not a martial arts program.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1436 - Self Defense for Men

Course teaches the Rape Aggression Defense System for men (TM). Participants will have the opportunity to raise their awareness of aggressive behavior. Hands-on self-defense skills to resist and escape aggressive behavior will be practiced.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1442 - Kickboxing II

Students will continue learning fundamental knowledge and skills specific to the course for participation and enjoyment as a lifelong recreational activity. Kickboxing is a martial art, combat sport, and a self-defense system that focuses on distance management, striking, and defense while on the feet.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1450 - Physical Education Fusion-Full

Self-paced class requires student to submit electronic tracking that documents activity on weekly basis. An electronic app is used to uniquely document physical activity time. A total of 14 hours of physical activity required for passing grade.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

PE 1451 - Mountain/Road Bike Fusion

Self-paced class requires student to submit electronic tracing that document activity on weekly basis. Electronic app used to uniquely document rides, distance, and pace. Total of 14 hours of riding required for passing grade. Students need to provide bike and safety equipment.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

PE 1470 - Lifeguard Swimming

Water strokes and skills required for Lifeguard Training. Requires strong 500-yard continuous swim using front crawl, breaststroke, and sidestroke. Students that successfully complete this course will earn a certification in American Red Cross CPR/AED/First Aid & Lifeguarding.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

PE 1480 - Water Safety Instructor

This course is to train instructor candidates to teach courses and presentation in the American Red Cross swimming and water safety program by developing their understanding of how to use the course materials, how to conduct training sessions, and how to evaluate participants' progress.
Credits: 1.0; Repeatable to a Max of 2
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Spring
Co-Requisite(s): KIP 2450

PE 2150 - Cross Training

A broad base understanding of sports cross training and activities that can be pursued as lifelong activities.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-5)
Semesters Offered: Fall, Spring
Restrictions: Permission of department required

PE 2210 - Special Topics in Physical Education

Unconventional activity courses that address varying and changing student interests. Topics vary. May be repeated if topics are different.
Credits: 1.0; Repeatable to a Max of 2; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required

Physics

PH 1090 - The Physics Behind Music

Physics concepts and methods associated with musical instruments, musical recording, and musical acoustics are discussed at an introductory level. Topics include periodic motion, normal modes and resonance, superposition and Fourier series, waves, sound and acoustics, magnetism and electromagnetic induction, and topics from non-linear physics. Course is also offered online on demand in spring and summer semesters.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring
Pre-Requisite(s): MA 1031(C) or MA 1032(C) or MA 1120(C)

PH 1091 - The Physics Behind Music Lab

A companion hands-on lab course covering topics from PH1090.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Pre-Requisite(s): PH 1090(C)

PH 1100 - Physics by Inquiry I

Experiments covering kinematics, force, conservation of momentum, conservation of energy, and waves are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): MA 1160(C) or MA 1161(C) or MA 1121(C)

PH 1110 - College Physics I

An overview of basic principles of kinematics, dynamics, elasticity, fluids, heat, thermodynamics, mechanical waves, and interference and diffraction of mechanical waves.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Major(s): Applied Physics, General Technology, Construction Management, Computer Network & System Admn, Electrical Eng Tech, Information Technology, Physics
Co-Requisite(s): PH 1111
Pre-Requisite(s): MA 1031 or MA 1032 or MA 1120 or MA 1135(C) or MA 1160(C) or MA 1161(C) or MA 1121(C) or ALEKS Math Placement >= 76 or CEEB Calculus AB >= 2 or CEEB Calculus BC >= 2 or CEEB Calculus AB Subscore >= 2 or ACT Mathematics >= 26 or SAT MATH SECTION SCORE-M16 >= 610

PH 1111 - College Physics I Laboratory

Experiments covering kinematics, forces, conservation of momentum and energy, waves, and thermodynamics are explored through guided construction. The course provides inquiry-based laboratory experiences for concepts explored in PH1110.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Restrictions: May not be enrolled in one of the following Major(s): Physics, Applied Physics
Co-Requisite(s): PH 1110

PH 1140 - Applied College Physics I

An algebra-based introduction to classical mechanics and its applications. Topics include kinematics, Newton's laws, impulse and momentum, work and energy, simple harmonic motion, mechanical waves and sound, and temperature and heat.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Mechatronics, Computer Science, Mechanical Engineering Tech, Construction Management, Computer Network & System Admn, Electrical Eng Tech, General Technology, Information Technology, Theatre & Entertain Tech (BS)
Co-Requisite(s): PH 1111
Pre-Requisite(s): MA 1031 or MA 1032 or MA 1120 or MA 1160(C) or MA 1161(C) or MA 1121(C) or MA 2160(C) and (PH 1100 or PH 1111 or PH 1141(C) or PH 1161)

PH 1160 - Honors Physics I - Mechanics

Calculus-based introduction to classical mechanics. Topics include mathematical concepts, kinematics, Newton's laws, the gravitational force, work and energy, and collisions. Also introduces departmental facilities, research within the department, and professional opportunities in physics. Intended for physics majors; highly motivated students seeking an invigorating introduction to physics may enroll with permission of the instructor.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Physics (BA), Physics, Applied Physics
Co-Requisite(s): PH 1161
Pre-Requisite(s): MA 1160(C) or MA 1161(C) or MA 1121(C) or MA 2160(C)

PH 1161 - Introduction to Experimental Physics I

A laboratory complement to PH1160. Experiments covering kinematics, force, conservation of momentum, conservation of energy, waves and thermodynamics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Physics (BA), Physics, Applied Physics
Co-Requisite(s): PH 1160

PH 1162 - Introduction to Physics Seminar

Introduction to the study of physics. Students will explore tools and habits for successful studies, understanding different undergraduate physic degrees, and course planning. Departmental research and career paths will be introduced through department faculty, Course also supports physics students' Essential Abilities.

Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Physics (BA), Physics, Applied Physics

PH 1200 - Physics by Inquiry II

Experiments covering Coulomb's law, electric and magnetic fields, circuits, induction, and geometric optics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.

Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): PH 1100 or PH 1111 or PH 1141 or PH 1161

PH 1210 - College Physics II

An overview of basic principles of static and dynamic electricity and magnetism, electromagnetic waves, reflection and refraction of light, interference and diffraction of light, special theory of relativity, wave theory of matter, particle theory of electromagnetic waves, theory of the atom, the nucleus, and elementary particles.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Restrictions: May not be enrolled in one of the following College(s): College of Engineering; May not be enrolled in one of the following Major(s): Applied Physics, Physics, Surveying Engineering, Computer Network & System Admn, Electrical Eng Tech, General Technology, Mechanical Engineering Tech, Information Technology, Construction Management
Pre-Requisite(s): PH 1200(C) and (PH 1110 or PH 1100)

PH 1240 - Applied College Physics II

An overview of static and dynamic electricity and magnetism, electromagnetic waves, basic optics, and an introduction to modern and nuclear physics with an emphasis on problem solving and applications.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Construction Management, Surveying Engineering, Electrical Eng Tech, General Technology, Mechanical Engineering Tech, Information Technology, Computer Network & System Admn
Co-Requisite(s): PH 1200
Pre-Requisite(s): PH 1140 or PH 1110

PH 1360 - Honors Physics II - Rotation and Vibration

Continuation of PH 1160. Topics include rotational motion, simple harmonic motion and mechanical waves. Offered first half of spring semester.

Credits: 2.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Co-Requisite(s): PH 1361
Pre-Requisite(s): (PH 1160 or PH 2100) and (MA 2160(C) or MA 3160(C))

PH 1361 - Introductory Experimental Physics II

Laboratory complement to PH 1360. Waves and thermodynamics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Spring
Co-Requisite(s): PH 1360

PH 1500 - Extraordinary Concepts in Physics

Extraordinary concepts will be surveyed. Included will be time dilation and length contraction in Special Relativity, physics of Time Travel, curvature in General Relativity, interpretations of Uncertainty Principle, counter-intuitive examples of Two-Slit Experiment, Schrodinger's Cat, Maxwell's Demon, Bell's Inequality, curvature in cosmology, dark matter, dark energy, black hole evaporation, string theory, and gravitational lensing.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: On Demand

PH 1600 - Introductory Astronomy

Introduces fundamentals of astronomy. Topics include Kepler's and Newton's laws of motion, origin and evolution of the solar system, galactic astronomy, extra-galactic astronomy, cosmology, and modern instrumentation, including space-based astronomy.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Fall, Spring, Summer

PH 1610 - Introductory Astronomy Lab

Demonstrates fundamentals of astronomy using non-telescopic and telescopic observations, and computer simulations. Topics include angular size measurements, season-dependent measurements, phases of the moon, phases and orbits of planets, brightness of stars, introduction to the use of MTU's Observatory, instrumentation, and applications of computer programs involving cosmology.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer
Co-Requisite(s): PH 1600

PH 2021 - Introduction to Programming in Physics

Compiled programming languages, command lines, and scripts, and graphical display of data will be used to solve simple problems in physics.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

PH 2100 - University Physics I-Mechanics

A calculus-based introduction to classical mechanics. Topics include kinematics, Newton's laws, impulse and momentum, work and energy, and the universal law of gravitation. C or better/AP credit in Calc 1 or co-requisite registration in PH2110 required.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): PH 1100(C) and (MA 1160 or MA 1161 or MA 1121 or MA 1135) or (CEEB Calculus AB >= 3 or CEEB Calculus BC >= 3 or CEEB Calculus AB Subscore >= 3 and MA 2160(C) or MA 3160(C))

PH 2200 - University Physics II-Electricity and Magnetism

A calculus-based introduction to electromagnetism. Topics include Coulomb's law, electric fields, Gauss's law, electric potential, capacitance, circuits, magnetic forces and fields, Ampere's law, induction, Maxwell's equations, and electromagnetic waves.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): (PH 1200(C) or PH 2261(C)) and (PH 2100 or PH 1160) and MA 2160

PH 2230 - Electronics for Scientists

An introduction to analog and digital electronics with an emphasis on their use in the laboratory. Topics include linear devices and basic linear circuit analysis; diodes; transistors; op-amps; the use of digital components, including logic gates, flip-flops, counters, clocks and microcontrollers, and analog to digital conversions.
Credits: 4.0
Lec-Rec-Lab: (3-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Major(s): Electrical Engineering, Computer Engineering
Pre-Requisite(s): PH 2200 or PH 2260

PH 2260 - Honors Physics III - Electricity and Magnetism

Calculus-based introduction to electromagnetism. Topics include Coulomb's law, electric fields, Gauss's law, electric potential, capacitance, circuits, magnetic forces and fields, Ampere's law, induction, Maxwell's equations, electromagnetic waves and geometrical optics.
Credits: 4.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 1160 or PH 2100) and (PH 1200(C) or PH 2261(C)) and MA 2160

PH 2261 - Introduction to Experimental Physics III

A laboratory complement to PH2260. Experiments covering Coulomb's law, electric and magnetic fields, circuits, induction, geometric optics, and modern physics are explored through guided construction. The course emphasizes understanding physical concepts through inquiry and the scientific method.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Co-Requisite(s): PH 2260
Pre-Requisite(s): PH 1100 or PH 1161

PH 2300 - University Physics III-Fluids and Thermodynamics

A calculus-based introduction to fluids and thermal physics. Topics include fluid motion, propagation of heat and sound, temperature and the kinetic theory of gases, heat capacity and latent heat, first law of thermodynamics, heat engines and the second law, entropy, and an introduction to statistical mechanics. Offered second half of spring semester.
Credits: 2.0
Lec-Rec-Lab: (4-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 1160 or PH 2100

PH 2400 - University Physics IV-Waves and Modern Physics

A calculus-based introduction to waves and modern physics. Topics include interference and diffraction, special relativity, photons and matter waves, the Bohr atom, wave mechanics, atomic physics, molecular and solid-state physics, and nuclear physics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): PH 2200 or PH 2260

PH 3110 - Theoretical Mechanics I

An intermediate study of mechanics, including the study of Newtonian mechanics of a single particle and multiple-particle systems, oscillations, motion in non-inertial reference frames, gravitation and central-force motion, and Lagrangian mechanics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 2200 or PH 2260) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 3111 - Theoretical Mechanics II

A continuation of PH3110. Includes the study of the rigid body motion, relativistic mechanics, and coupled oscillations. Additional topics may include chaos theory, Hamiltonian mechanics, and continuous systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 3110

PH 3210 - Optics

An introduction to geometrical and physical optics. Topics in geometrical optics include ray analysis of mirrors, lenses, prisms, and optical systems. Topics in physical optics include polarization, interference, interferometry, and diffraction. The laboratory explores optics through experiments in imaging, fiber optics, interferometry, diffraction, polarization, and laser beam propagation.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): MA 3520(C) or MA 3521(C) or MA 3530(C) or MA 3560(C)

PH 3300 - Thermodynamics and Statistical Mechanics

Thermodynamic systems, heat, work, laws of thermodynamics, formal mathematical relations, cycles, phase equilibrium, and multicomponent systems. Elementary kinetic theory. Introduction to microscopic view of entropy, ensemble theory, and applications of statistical mechanics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 2300 or PH 1360

PH 3320 - Methods of Theoretical Physics

Introduction to the techniques and methods frequently encountered in advanced physics with a particular emphasis on application to physical problems. Topics include, but are not limited to, complex numbers, vector analysis, partial differential equations, and integral transforms.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): MA 3160 and (MA 3520 or MA 3521 or MA 3530 or MA 3560) and (PH 2200 or PH 2260)

PH 3410 - Quantum Physics I

An introduction to the foundations of modern physics and Schrodinger's wave mechanics. Topics include thermal radiation, particle-like properties of radiation, Bohr's model of the atom, matter waves, Schrodinger's wave mechanics, quantization of angular momentum, and the one-electron atom.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 3411 - Quantum Physics II

A continuation of PH3410. Includes the study of spin and magnetic interactions, multi-electron atoms, quantum statistics, molecules, solids, and elementary particles.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PH 3410

PH 3480 - Advanced Physics Laboratory

Through a series of experiments, students investigate physical phenomena that underlie modern physics. In the process, students become familiar with experimental techniques and instrumentation used in modern research laboratories.
Credits: 2.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Pre-Requisite(s): PH 3210

PH 4010 - Senior Physics Colloquium I

Class discussion of the literature in the field of physics. Requires oral and written presentations.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4080

PH 4011 - Senior Physics Colloquium II

A continuation of PH4011. Class discussion of current literature and recent advances in physics. Requires oral and written presentations.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4081
Pre-Requisite(s): PH 4010

PH 4050 - Qualitative Methods in Physics

General methods and approaches of the physicist, including modeling, scaling, numerical estimation, and dimensional analysis as applied to the development, understanding, and solution of physics problems. Serves as an excellent preparation for students taking the GRE Subject Test in physics.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Physics, Applied Physics; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

PH 4080 - Senior Research I

Introduction to research under the guidance of a faculty member. In addition, creative problem solving will be assessed via a student-initiated project.
Credits: 3.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4010
Pre-Requisite(s): PH 3480

PH 4081 - Senior Research II

Continuation of research under the guidance of a faculty member, culminating in a written report and presentation of results at an undergraduate research forum.
Credits: 3.0
Lec-Rec-Lab: (0-0-6)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Co-Requisite(s): PH 4011
Pre-Requisite(s): PH 4080

PH 4090 - Senior Thesis

Students prepare an in-depth written thesis on an approved topic in physics. Normally taken the last semester before graduation in conjunction with PH4081.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

PH 4210 - Electricity and Magnetism I

Intermediate study of the basic theory of electricity and magnetism, including a detailed study of electrostatic field theory and an introduction to magnetostatics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): (PH 2200 or PH 2260) and PH 3110 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4211 - Electricity and Magnetism II

A continuation of PH4210. Intermediate study of magnetostatics, electrodynamics, and electromagnetic waves.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PH 4210

PH 4292 - Light and Photonic Materials

Material properties controlling light wave propagation in optical crystals and optical waveguides. Photonic crystals and photonic devices based on electrical, magnetic, and strain effects.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): PH 2200(C)

PH 4390 - Computational Methods in Physics

An overview of numerical and computer methods to analyze and visualize physics problems in mechanics, electromagnetism, and quantum mechanics. Utility and potential pitfalls of these methods, basic concepts of programming, UNIX computing environment, system libraries and computer graphics are included.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Fall
Pre-Requisite(s): (PH 2021 or PH 2020) and PH 3410

PH 4395 - Computer Simulation in Physics

Role of computer simulation in physics with emphasis on methodologies, data and error analysis, approximations, and potential pitfalls. Methodologies may include Monte Carlo simulation, molecular dynamics, and first-principles calculations for materials, astrophysics simulation, and biophysics simulations.
Credits: 3.0
Lec-Rec-Lab: (2-0-3)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): PH 3300 and PH 4390 and (PH 2400 or PH 3410)

PH 4510 - Introduction to Solid State Physics

Crystal structures, X-ray diffraction, phonons, free electron theory of metals, rudiments of band theory, an overview of semiconductors, and other topics in solid-state physics.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): (PH 2300 or PH 1360) and PH 2400 and (CH 1150 and CH 1151) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4610 - Stellar Astrophysics

Topics include an overview of observational astrophysics, stellar atmospheres, stellar structure, atomic properties of matter, radiation and energy transport in stellar interiors, and stellar evolution to and from the main sequence. Course offered every third year beginning 2008-09.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): PH 1600 and PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4620 - Galactic Astrophysics

Topics include the composition and dynamics of our galaxy, dynamics of stellar encounters, spiral density wave theory, clusters of galaxies, theoretical cosmology, physics of the early universe, and observational cosmology. Course offered every third year beginning 2009-10.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): PH 1600 and PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4630 - Particle Astrophysics

Introduction to the twin fields of elementary particle physics and high energy astrophysics. Topics include an overview of particles and interactions, the expanding universe, conservation laws, dark matter and dark energy, large scale structure, and cosmic particles. Course offered every third year beginning 2007-08.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): PH 2400 and (MA 3520 or MA 3521 or MA 3530 or MA 3560)

PH 4710 - Methods of Teaching Physics

Hands-on exploration of physics education methods in classroom, laboratory, and tutoring environments. Students study highlights of physics education research and explore use of several tools and pedagogical techniques, including web-based homework systems, simulations, classroom feedback systems, and equipment for laboratories and lecture demonstrations.

Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PH 1210 or PH 2200 or PH 2260

PH 4999 - Special Topics in Physics

Selected additional topics in physics for advanced students based on interests of faculty and students. Interested students should contact the physics department.
Credits: variable to 9.0; May be repeated
Semesters Offered: Fall, Spring, Summer

Psychology

PSY 1100 - Life Skills for Building Emotional Resilience

Learn to utilize skills, including mindfulness, emotion regulation, interpersonal effectiveness and distress tolerance, in a manner that provides a healthy foundation for successful navigation of life's challenges. Gain and apply physical and cognitive skills for reducing anxiety, improving relationships, and building resilience.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-1)
Semesters Offered: On Demand

PSY 1101 - Performance Through Biofeedback/MSPE

Biofeedback and Mindful Sport Performance Enhancement (MSPE) have been shown to improve performance and one's ability to adapt effectively to stress and environmental demands. Students in the course will acquire skills helpful in reducing performance anxiety, self-criticism, and/or comparisons to others.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
Semesters Offered: On Demand

PSY 1102 - Practical Approaches for Emotional Regulation

This course will examine the relationship between emotions, cognition, and behaviors. The ability to recognize one's emotions as they are occurring is foundational in strengthening one's emotional intelligence. This course provides tools utilized to expand one's ability to tolerate negative emotions.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
Semesters Offered: On Demand

PSY 1103 - Mindfulness Based Stress Reduction (MBSR)

This course utilizes evidence-based mindfulness techniques to assist in coping and responding to stress, decreasing anxiety, and improving focus and resilience. The course will cover foundational principles, practices, and impacts of MBSR to allow application in daily life.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
Semesters Offered: On Demand

PSY 1104 - Motivation through Self-Compassion

Practicing self-compassion allows us to continue to be motivated to reach our goals while being there for ourselves even when we feel like things aren't going our way. Through this course, individuals will learn how to be more self- compassionate through activities, self-reflection, and meditation.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
Semesters Offered: On Demand

PSY 1105 - Foundations of Well-Being

This course focuses on aspects of well-being related to positive mental health and life satisfaction. The course will explore topics including physical health, negative and positive life events, social relationships, income, goal setting, and how they relate to well-being.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
Semesters Offered: On Demand

PSY 1999 - Intro to the Psychology Major

Psychology majors examine the field of psychology and major degree requirements resulting in an undergraduate plan of study focused on graduate school admission or career preparation. Students will be introduced to department research and other opportunities.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Psychology, Human Factors; Must be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000(C)

PSY 2000 - Introduction to Psychology

Introduction to the scientific study of psychological structures and processes involved in individual and group behavior. Explores theoretical accounts of the foundations of human behavior and examines empirical support. Topics may include personality, disorders, therapy, development and social psychology, perception, learning, cognition, emotion, and states of consciousness.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer

PSY 2010 - Wellness and Resilience for College and Beyond

Resilience is not only adapting in the face of adversity (surviving), but also learning skills that enable a happy, successful life (i.e. thriving). Research shows that the use of resilience strategies and emotion regulation skills is associated with effectiveness in job roles, strong relationships, physical/mental health, and overall life satisfaction.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

PSY 2080 - Special Topics in Psychology

An in-depth analysis of current issues in Psychology. Course content varies with each offering.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000

PSY 2081 - Psychology of Video Games

Video games are a great example of psychology and human factors in action. Video games effectively apply psychological theories from cognition to motivation theory, from personality to team play. Through the lens of these disciplines, we will examine play and UX in games.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: On Demand
Pre-Requisite(s): HF 2000 or PSY 2000

PSY 2082 - Psychology of Friendship

Explores concepts of friends and friendship from psychological and social perspectives. Students gain perspective on how friendships form and function as a result of who they are as individuals and will recognize the impact of healthy and unhealthy friendships.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000(C) or HF 2000(C)

PSY 2083 - Psychology of Happiness

Examines theory, research, and evidence-based practices in the psychology of happiness and well-being. Students will gain a broader and more nuanced understanding of what happiness is, how to study it, and the range of issues it interacts with including of wealth, relationships, technology, health, global happiness, spirituality, and mental health.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 or HF 2000

PSY 2110 - Educational Psychology

The application of psychological factors, theory and research results to teaching and learning. Factors associated with both the learner (development, motivation, personality, behavioral and cognitive factors) and socio-technical learning environments (technology and multimedia, measurement, and evaluation) are examined.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years

PSY 2200 - Behavior Modification

An introduction to techniques of behavior modification through the application of learning theories such as classical and operant conditioning. Students will conduct a case study project designed to modify and assess a personal behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): PSY 2000

PSY 2400 - Health Psychology

Examines the theoretical, empirical, and historical bases for health psychology. Topics may include the effects of stress, determinants of addictive behavior, the impact of psychological factors on physical health, obesity, and the causes and treatment of chronic pain.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): PSY 2000

PSY 2600 - Psychology of Death and Dying

An examination of theory, research, and issues in the psychology of death and dying. Topics may include the development of death concepts, death anxiety in society, the needs of the dying person, the psychology of grieving, and unexpected losses.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): PSY 2000

PSY 2720 - Statistics for the Behavioral Sciences

Explores contemporary statistical methods in scientific research, emphasizing effect size estimation, meta-analysis, and open science practices. Students will apply these techniques to real-world research, with a focus on psychology and related fields.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Psychology, Social Sciences, Human Factors
Pre-Requisite(s): MA 1020 or MA 1030 or MA 1031 or MA 1032 or MA 1120 or MA 1160(C) or MA 1161(C) or MA 1135(C) or MA 1121(C) or ALEKS Math Placement >= 61 or CEEB Calculus BC >= 2 or CEEB Calculus AB Subscore >= 2 or ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540

PSY 2800 - Critical Thinking for Social and Behavioral Sciences

This course will help develop critical thinking skills central to the social and behavioral sciences. Topics may include arguments, logic, evaluating causal claims, evaluating surveys, theory evaluation, experiment evaluation, writing in psychology, and ethical considerations in the social and behavioral sciences. Learning APA writing style is a component of this course.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): PSY 2000(C)

PSY 2900 - Intro to Restorative Practices

Restorative justice practices allow those who have been most affected by an incident to share their feelings, describe how they have been affected and develop a plan to repair the harm done and prevent recurrence. The process is useful for K-12 schools, criminal justice, higher education and workplaces.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

PSY 3000 - Research Methods in Psychology & Human Factors

Introduction to experimental design, general research methodology, computer analysis and interpretation of data. Emphasizes issues and methods involved in psychological research. Topics include experimental design and validity, choosing appropriate data analysis techniques, statistical analysis, and APA writing style.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Psychology, Human Factors; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (PSY 2000 or HF 2000) and (MA 2720(C) or PSY 2720(C) or SS 2720(C))

PSY 3001 - Research Methods in Psychology & Human Factors II

Second course in psychological research methodology and statistics, both experimental and non-experimental. Students design, execute, interpret, and report psychological research.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Psychology, Human Factors; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (PSY 2000 or HF 2000) and PSY 3000

PSY 3010 - Theories of Personality

Introduction to the variety of approaches to personality that underlie many clinical models. Discusses the formulation of personality theory, its purpose, and problems associated with personality theory generation. Emphasizes classical and contemporary theories of personality, their various applications to human behavior, and a review of relevant research findings.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years, Spring, in even years
Pre-Requisite(s): PSY 2000 and UN 1015

PSY 3030 - Abnormal Psychology

Helps the student build an understanding of abnormal behavior through critical examination of historical and contemporary models used in this field. The student learns the causes and treatment proposed by Cognitive-Behavioral, Psychodynamic and Sociocultural Models with particular emphasis placed on the Diagnostic and Statistical manual used by clinicians for diagnoses.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): PSY 2000 and UN 1015

PSY 3040 - History and Systems of Psychology

Traces major historical contributions to current psychology from ancient to modern times. Examines significant ideas and discoveries from philosophy, mathematics, and the natural and medical sciences as they relate to the development of psychology. Discusses philosophical, theoretical, and methodological controversies that surfaced as part of these historical developments.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000

PSY 3060 - Brain and Behavior

Examines the relationship between psychological phenomena and physiological mechanisms, focusing on brain function and nervous system activity. Students will explore psychophysiological measurement methods, current research, and practical applications in understanding human behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): (PSY 2000 or HF 2000) and BL 2010 or (BL 1200 and BL 1210) or (BL 1400 and BL 1410)

PSY 3090 - Directed Research: Undergraduate Research Assistant in Psychology

Directed research in the field of Psychology through the application of research techniques.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology, Human Factors; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000

PSY 3095 - Teaching Assistant

Undergraduate Teaching Assistant for Introduction to Psychology or other Psych course, including tutoring, assessment, test construction.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology
Pre-Requisite(s): PSY 2000

PSY 3100 - Applied Counseling Techniques

An applied review of counseling techniques, their strengths and weaknesses, and the fundamental concepts that support the use of each type of counseling. This is a course in which students will be required to apply and practice one of the counseling techniques with a voluntary client.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 and PSY 3030

PSY 3200 - Motivation and Emotion

Introduction to the theoretical, physiological, cognitive, and behavioral factors underlying the processes of motivated behaviors and emotional states. Emphasis is placed on methods for studying motivation and emotion and their role in human behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 or HF 2000

PSY 3340 - Psychology of Race

This course reviews the history and evolution of the construct of race as a psychological and historical construct. The course will emphasize a theoretical and conceptual approach toward understanding the foundations of racialized world views. The historical and contemporary implications for policy and practice are considered.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): PSY 2000 and UN 1015

PSY 3400 - Developmental Psychology

A survey of human development across the life span (prenatal, infant, child, adolescent, and adult) in the areas of biological, cognitive, social, emotional, and personality development. Provides insight into both the universality of human development and the uniqueness of individuals.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): PSY 2000

PSY 3600 - Cognitive Psychology

Through lecture, demonstrations, and participation in classic cognitive experiments, this course provides a survey of topics in human cognition, including perception, attention, mental representation and processing, the architecture of memory, knowledge, visual imagery, problem solving, reasoning, and decision making.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 or HF 2000

PSY 3700 - Industrial Organizational Psychology

Introduction to the use and application of psychology in the workplace. Focus is on the development of employees and the management of work groups and organizations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 or HF 2000

PSY 3720 - Social Psychology

Survey of social, cultural, and cognitive influences on individual and group behavior. Introduces attitude formation, social conformity, personal perception, aggression, cooperation, and interpersonal and intergroup relations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): PSY 2000 and UN 1015

PSY 3800 - Environmental Psychology

Psychological effects of the physical environment and effects of human action on the sociophysical environment, including an examination of global environmental issues and ecologically-relevant behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (PSY 2000 or HF 2000) and UN 1015

PSY 3880 - Psychology of Social Media

The class examines the application of theories of psychology and principles of communications to understand the interaction between media use, message content, and the effects on users. Social media is studied through the lens of theories such as social cognitive theory, perceived reality/cultivation theory, and the theory of planned behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 and UN 1015

PSY 3999 - Psychology Third Year Seminar

A practical, task-based course to help you synthesize your post-bachelor's degree plans and goals. Involves work on applying to an advanced educational program or conducting a job search.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman, Sophomore

PSY 4031 - Psychology of Trauma

A multidisciplinary course focused on the prevalence of trauma and violence in society and global communities. The course is devoted to exploring the causes of trauma from a psychological framework, focusing on the prevention and reduction of physical, psychological, sexual, emotional, cultural, and cyber-based violence.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): PSY 3030

PSY 4080 - Topics in Psychology

An examination of a specific area or approach within the field of Psychology.
Credits: variable to 4.0; May be repeated
Semesters Offered: On Demand
Pre-Requisite(s): PSY 2000 and UN 1015

PSY 4090 - Independent Study in Psychology

Designed to allow students to participate in independent readings or research in a variety of areas within psychology.
Credits: variable to 6.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000

PSY 4095 - Internship in Psychology

Firsthand experience with the application of psychological principles in the field through volunteer placement on campus or with a community agency or business. Students are responsible for obtaining field placement site in coordination with instructor. Students complete a comprehensive paper.
Credits: variable to 3.0; Repeatable to a Max of 6; Graded Pass/Fail Only
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000

PSY 4110 - Learning and Memory

Theories of learning and memory from traditional animal research findings, human research, and more recent trends examining the neural basis of learning and memory will be examined to understand changes in behavior, including the acquisition and retention of knowledge.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): PSY 2000 or HF 2000

PSY 4160 - Sensation and Perception

Examination of basic sensory mechanisms and perceptual phenomena. Sensory mechanisms reviewed will include vision, audition, olfaction, gustation, vestibular system and touch.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 or HF 2000

PSY 4340 - Culture and Cognition

The course explores the relationship between culture and cognition and their interactions. Theories and research methodologies related to culture and cognition are covered. The course involves developing an awareness of personal analytic frameworks. Application in different arenas are considered (e.g. family and community spaces, workplaces).
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): (PSY 2000 or HF 2000) and UN 1015

PSY 4400 - Tests and Measurements

Review of psychological tests and test theory, along with principles of construction and analysis of psychological tests.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): FR
Pre-Requisite(s): PSY 2720 or MA 2720

PSY 4720 - Advanced Social Psychology

Advanced examination of a specific area or approach within the field of social psychology. Social psychology focuses on the power of the situation in people's lives affecting their attitudes, beliefs and decisions, and policies.
Credits: variable to 3.0
Semesters Offered: On Demand
Pre-Requisite(s): PSY 3720

PSY 4750 - Judgment and Decision Making

How can we make better decisions? Using examples from medicine, politics, law, business, and daily life, we review "descriptive" (psychological), "normative" (rational), and "prescriptive" (decision-engineering) theory. Topics include judgment, cognition, emotion, risk, uncertainty, heuristics, biases, and applications.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): PSY 2000 or HF 2000

PSY 4999 - Fourth-Year Seminar: Psychology Capstone

A writing-intensive course that will involve integrating and reflecting on various aspects of your undergraduate experience and completing a capstone project.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Psychology; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior
Pre-Requisite(s): PSY 3999

Sciences and Arts

SA 1000 - Exploring Majors at Michigan Tech

Exploration of majors and related career opportunities. Includes an introduction to University resources such as the Career Center, presentations by students in various majors, an examination of individual interests and abilities, opportunities for discussion and reflection, and guidance in choice of appropriate courses.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring

Systems Administration Technology

SAT 1000 - Introduction to Applied Computing

Course provides an overview of Applied Computing degrees designed especially for first year students. Content includes Michigan Tech's Essential abilities, technical presentations by faculty and community members, and exposure to trending topics in information technology, cybersecurity, and electrical engineering technology, and mechatronics.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall

SAT 1090 - Special Topics in Applied Computing

Special topics in applied computing offered based on student and faculty demand and interest. Intended primarily for first-year students.
Credits: variable to 3.0
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

SAT 1610 - Computer and Operating Systems Architecture

Fundamentals of computer organization, operating system architecture, PC/WS major subassemblies, PC and server configuration planning, power interfaces, system assembly/set-up, connection of peripherals, installing fundamental operating system software, system testing/debugging and planning and installation of application software portfolios.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 1200 or CS 1111

SAT 1700 - Cyber Ethics

Ethics, morality, and privacy issues when working with technology. Topics include: foundational and professional issues in cyber ethics; privacy, security, and crime in cyberspace; intellectual property and internet regulation; the digital divide and online communities; and emerging and converging technologies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

SAT 2343 - Network Administration I: Net Fundamentals

Introduction to basic networking concepts and implementation. Topics include OSI model, subnetting, network addressing, data encapsulation, network topologies, ethernet and basic configuration of network hardware including cabling, bridges and other communications.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior

SAT 2511 - Microsoft System Administration

Microsoft server installation and configuration in an enterprise environment. Topics include: planning for server deployment and management; monitoring and maintaining servers; planning application and data provisioning; and planning for business continuity and high availability.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring, Summer
Pre-Requisite(s): SAT 2343

SAT 2711 - Linux Fundamentals

Fundamental OS concepts, OS design principles, Linux system architecture, Linux installation and package management, GNU and UNIX commands, Linux file systems, hierarchy standards, shells, scripting and data management, user interfaces and desktops, administrative tasks, essential system services, networking fundamentals, and security.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Pre-Requisite(s): SAT 1200 or CS 1111(C) or CS 1121 or CS 1131 or CS 1142 or MIS 2100

SAT 3210 - Database Management

Introductory course on database management. Topics include data modeling, database design, implementation techniques, SQL Language, database administration and security.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SAT 2711 or (CS 2311 and CS 2321)

SAT 3310 - Scripting for Administration, Automation, and Security

Scripting in PERL, Python, BASH, and PowerShell to accomplish and automate common system administration tasks such as working with files, network and web communication, database interaction, and security.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Sophomore, Junior, Senior
Pre-Requisite(s): CS 1111 or CS 1121 or CS 1131 or CS 1142 or MIS 2100

SAT 3343 - Network Administration II: Net Operations

Study of network devices in various architectures. Topics include routing protocols, TCP/IP design, VLAN and STP, NAT, access control lists, VPNS and switch/router configurations and troubleshooting.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring, Summer
Pre-Requisite(s): SAT 2343 or CS 3411

SAT 3611 - Infrastructure Service Administration and Security

Administrating Linux and Microsoft servers together to provide infrastructure services to mixed clients. Topics include: DNS; DHCP; file, web, mail, and directory security of these services; and best practices for combining and mixing server platforms in an enterprise environment.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Summer
Pre-Requisite(s): SAT 2711

SAT 3812 - Cyber Security I

The evolution of information security into cybersecurity and its relationship to nations, organizations, society, and individuals. Exposure to multiple cybersecurity technologies, processes, and procedures; analyzing threats, vulnerabilities and risks present; and developing appropriate strategies to mitigate potential cybersecurity issues. Applied lab to develop cyber security offensive attributes and learn how to prevent and/or mitigate threats.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, Spring, Summer
Pre-Requisite(s): SAT 2711 or CS 2321 or MIS 3200

SAT 3820 - Wireless System Administration and Security

Study of wireless communications, standards, and regulations in an enterprise environment. Topics include: various radio frequency and light communications; IEEE 802.11 Regulations and Standards; protocols and devices; network implementation; network security; and site surveying.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SAT 2343

SAT 3830 - Discrete Structures for Computing

Fundamental concepts of discrete math and discrete structures used in computing. Topics include discrete data structure, graph theory, logic and set theory, mathematical reasoning, number theory and cryptography, functions and relations.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Spring
Pre-Requisite(s): SAT 3310(C)

SAT 4114 - Artificial Intelligence in Healthcare

This course introduces students to clinical data and artificial intelligence (A1) methods in healthcare. Health AI topics such as risk prediction, medical image analysis, natural language processing of clinical text, computer vision, and the integration of AI, bias in algorithm development, bioethics, and regulation into the clinical environment are covered.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SAT 4650

SAT 4283 - Information Governance and Risk Management

Course will consist of the legal and regulatory requirements and security privacy concept principles regarding enterprise information. Best practices of how organizations manage information risk through risk assessment practices and procedures will be conducted.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SAT 4310 - Advanced Scripting Programming

Emphasizes advanced portions of scripting programming, testing, implementation and documentation (i.e. PERL, PHP, Python and Scripting). Other topics include language syntax data and file structures, input/output devices, file, database access, and graphical user interfaces.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Pre-Requisite(s): CS 1111 or CS 1121 or CS 1131 or MIS 2100

SAT 4343 - Network Administration III: Large Scale Design

Study of large network configuration and design. Topics include advanced routing and switching protocols such as BGP, SD-WAN and MPLS, Policy based routing vs. standard routing, firewalls with firewall rules, network automation tools, configuration and troubleshooting of network devices.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall, in even years, Spring, in even years
Pre-Requisite(s): SAT 3343

SAT 4411 - Data Center Operations

Introduction to Datacenter architectures and virtualization in an enterprise environment. Topics include datacenter hardware, design and planning, disaster recovery, differences in virtualization platforms, cloud computing platforms, storage technologies such as NFS, SMB and Fibre Channel, configuration and troubleshooting of virtual clusters.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 3210 or SAT 3611 or CS 3425

SAT 4424 - Population Health Informatics and Monitoring

Introduces organization context of health data for the use of managing populations. Types of health data sources, interventions, data analytics, and policy factors affecting population health are covered. Also explores how information is used for managing population health surveillance.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SAT 4422 or BL 2010 or BL 3080 or EH 1500 or KIP 1500 or SAT 5121

SAT 4480 - Senior Project I

Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Information Technology, Computer Network & System Admn, Cybersecurity; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): SAT 3812(C)

SAT 4520 - Machine Learning in Security

Study of artificial intelligence and machine learning in cybersecurity. Topics include fundamentals of common machine learning and deep learning algorithms, intelligent threat detection and analysis, user behavior analytics, machine learning in hacking, and automated cybersecurity systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring
Pre-Requisite(s): SAT 3812 and SAT 4310

SAT 4650 - Introduction to Applied Computing in Python Programming

This course introduces students to the Python programming language in applied computing systems and applications. In addition to Python basics, introduction to advanced topics such as file operations, database connection, digital image processing, and artificial intelligence will be discussed, particularly within the field of health informatics.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

SAT 4812 - Cyber Security II

An advanced course in cyber security that covers topics such as adversarial thinking, exploiting game theory, human-centered cyber security, economic decision making in cyber security, and the National Initiative for Cybersecurity Education (NICE) framework topics of Analyze, Collect and Operate, Investigate, Operate and Maintain, Oversee and Govern, Protect and Defend, and Securely Provision.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Spring, Summer
Pre-Requisite(s): SAT 3812

SAT 4816 - Digital Forensics

Introduction of the basic principles and technology of digital forensics, including acquisition, preservation, and recovery and investigation of the evidence stored in digital devices.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Computer Network & System Admn, Computer Engineering, Computer Science, Cybersecurity, Information Technology; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SAT 3812

SAT 4817 - Security Penetration Testing and Audit

To provide knowledge and demonstrated methods to help prevent security breaches and develop safeguards to protect sensitive information and confidential data. Students learn offensive and defensive security concepts, audit best-practices.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): SAT 3812

SAT 4880 - Senior Project II

Capstone course requiring the application of knowledge gained in lower division courses. Projects are team oriented, require weekly progress reports, and culminate with a final report and oral presentation.
Credits: 2.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Information Technology, Computer Network & System Admn, Cybersecurity; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): SAT 4480

SAT 4996 - Special Topics in Applied Computing

Selected additional topics of interest applied computing based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Information Technology, Computer Network & System Admn, Cybersecurity; Must be enrolled in one of the following Class(es): Senior

SAT 4997 - Independent Study in Applied Computing

Independent study of an approved topic under the guidance of a Computer Network Systems Administration faculty member. May be either an academic, design, or research problem/project.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Information Technology, Computer Network & System Admn, Cybersecurity; Must be enrolled in one of the following Class(es): Senior

SAT 4998 - Undergraduate Research in Applied Computing

An undergraduate research experience in Computer Network Systems Administration. Under the guidance of a CNSA faculty member, students work on a selected/approved research problem or work directly with faculty on active research projects/grants. May require more than one semester to complete.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Information Technology, Computer Network & System Admn, Cybersecurity; Must be enrolled in one of the following Class(es): Senior

Sound

SND 1000 - Sound in Art and Science

Sound design of movies is critical to their success because of sounds incredible power over the way we feel. From the music and sound effects in movies, to Zen gardens, to Harley exhaust we explore the ways sound provides a foundational emotional engagement to our experience of the world around us.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Summer

SND 1101 - Introduction to Music Mixing

A hands-on introduction to mixing music with emphasis on the support of musical principles and style. Students develop a technical understanding and practice the manipulation of volume, frequency, dynamics, pitch, and time to support the focus, rhythm, melody, and mood of a wide variety of musical styles.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

SND 1102 - Introduction to Audio Production

An introduction to hands-on creative and technical work in sound. Work covers script analysis, storytelling approaches, dialog direction and editing, sound effect and ambiance design, music integration and DAW based mixing.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

SND 1150 - Sound Technology

Introduction to the technological fundamentals, both practical and theoretical, of sound equipment and systems for the performing arts. Focus on the basics of sound physics, sound measurement and perception, and sound system components and interconnections.

Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

SND 1570 - Private Mixing Instruction

Professional private instruction on music mixing.
Credits: 1.0; May be repeated; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Major(s): Sound Design, Audio Production & Technology
Pre-Requisite(s): FA 1602 or SND 1101

SND 1610 - Sound Practicum I

Students get hands-on experience in live and recorded sound as well as in system maintenance and design. This work is done in a simulated internship experience. Students are expected to take this course multiple times and work towards leadership positions.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring

SND 2120 - Sound Systems Design and Engineering

Fundamentals of sound systems design & engineering for a variety of entertainment industry scenarios, including: speaker coverage, system tuning, DSP programming, technical documentation, design phases, revision control, interaction with clients, interaction with design teams in other disciplines, and budget estimation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Theatre & Entertain Tech (BS), Sound Design, Audio Production & Technology; May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SND 1101 and SND 1150

SND 2150 - Recording

Learning in the art of the recording engineer. Students develop an understanding of pop and classical recording approaches, skills to decide which approach is appropriate for a given task, and the technical knowledge necessary to implement the chosen approach.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Sound Design, Theatre & Entertain Tech (BS), Theatre & Electr. Media Perf., Audio Production & Technology
Co-Requisite(s): SND 2151
Pre-Requisite(s): (FA 1601 or SND 1102) and (FA 1602 or SND 1101) and (FA 1702 or SND 1150)

SND 2151 - Recording Lab

Hands-on learning in the art of the recording engineer. Students develop an understanding of pop and classical recording approaches, skills to decide which approach is appropriate for a given task, and the technical knowledge necessary to implement the chosen approach.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Theatre & Entertain Tech (BS), Sound Design, Audio Production & Technology
Co-Requisite(s): SND 2150
Pre-Requisite(s): (FA 1601 or SND 1102) and (FA 1602 or SND 1101) and (FA 1702 or SND 1150)

SND 2610 - Sound Practicum II

Students get hands-on experience in live and recorded sound as well as in system maintenance and design. This work is done in a simulated internship experience. Students are expected to take this course multiple times and work towards leadership positions.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring
Pre-Requisite(s): SND 1610

SND 2663 - Career Development: Sound

Provides students the opportunity to attend professional events which contribute to the development of their careers. Students will experience seminars, workshops, performance opportunities, competitions, and may perform services and interact with professionals at such events as AES and USITT.
Credits: 1.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Sound Design, Theatre & Entertain Tech (BS), Theatre & Electr. Media Perf., Audio Production & Technology

SND 2664 - Career Development: AES National Conference

Students attend the Audio Engineering Society international conference usually held in New York City. In addition to the professional workshops and networking available at the conference, students will have opportunities to tour local venues, experience professional productions, and learn how to navigate a city.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall

SND 2665 - Career Development: AES Student Summit

Students will attend the Audio Engineering Society Student Summit. In addition to the professional workshops and networking available at the summit, students will have opportunities to experience grad school and/or professional companies as scheduled events on the trip.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Spring

SND 3330 - Sound Design

Introduction to designing sound through design projects. Focuses on fundamental technical understanding, practical design presentation techniques, specific drafting conventions, exploration of sound equipment, designer/ director/artist relationships, script analysis and design concepts, and design history.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Pre-Requisite(s): SND 1102 and SND 1101

SND 3610 - Sound Practicum III

Open to students who take significant responsibility for sound on a major production, such as sound designer, recording engineer, live sound engineer.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring
Pre-Requisite(s): SND 2610 and (SND 2120 or SND 2150)

SND 3620 - Audio Creative Lab

A creative lab for students interested in the aural arts. Students will be challenged to create sound designs and compositions in response to various aesthetic, dramatic, and philosophical goals for radio, multimedia, and live performance.
Credits: 3.0; Repeatable to a Max of 12
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SND 1102 and SND 1101 and SND 3330

SND 3663 - Professional Presentation

Provides students the opportunity to present at professional events which contribute to the development of their careers. Students will prepare and present design, technical, or performance projects, papers, and/or posters to be viewed and critiqued by professionals at such events as KCACTF, AES, USITT, and URTA.
Credits: 1.0; Repeatable to a Max of 4
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Pre-Requisite(s): (SND 2120 or SND 3330 or SND 3610) and THEA 3650(C)

SND 3664 - Professional Presentation: AES National Conference

Students will attend and present at the Audio Engineering Society international conference usually held in New York City. Presentation opportunities range from mixing competitions and critiques to portfolio reviews and meetings with targeted professionals relevant to students interests.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall
Pre-Requisite(s): SND 2120 or SND 3330 or SND 3610 and THEA 3650(C)

SND 3850 - Special Topics: Sound

Examines important themes, processes, and issues in sound, including local and global traditions. Spans a variety of creative practices. Creative projects, lectures, readings, and discussions. May be repeated if topics differs.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required

SND 3860 - Special Topics: Sound

Tutorial, seminar, or class study of a topic of special interest and importance in visual and performing arts.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand

SND 4120 - Transducer Theory

In depth study of Microphone and Loudspeaker design as it applies to usage in recording and live sound reinforcement with an emphasis on interaction with the acoustical environment
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Co-Requisite(s): SND 4121
Pre-Requisite(s): SND 1150 and SND 2120 and PH 1090 and UN 1015

SND 4121 - Transducer Theory Lab

Laboratory to practice the application of loudspeaker and microphone principles. Designed to be taken concurrently with FA4740 Transducer Theory.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Co-Requisite(s): SND 4120

SND 4610 - Sound Practicum IV

Students propose and lead creative or technical projects that demonstrate mastery of several integrated audio concepts. Project types are flexible depending on students' intended career goals and prior course experience.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring
Pre-Requisite(s): SND 3610 and SND 3330

SND 4620 - Live Sound Design Intensive

Students design, install, program, run, and record a major live production. Sound will be an essential part of the story telling experience requiring a close relationship with the actors and extensive integration with other design elements.
Credits: 3.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Sound Design, Theatre & Entertain Tech (BS), Theatre & Electr. Media Perf., Audio Production & Technology; May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SND 1101 and SND 1102 and SND 1150 and SND 2120 and SND 2610 and SND 3330

SND 4800 - Independent Study: Sound

Independent research directed by Visual and Performing Arts faculty. Projects focus on one or more of the visual and performing genres; theatre, music, visual art. Requires a written proposal setting out goals, plans for final project, and the resources required to complete the project.
Credits: variable to 6.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

SND 4900 - Visual and Performing Arts Final Project

Capstone course extending the student's knowledge and skill in a chosen fine arts discipline through independent research or other focused creative activity. A detailed proposal of the student's final project must be approved in writing by a Visual and Performing Arts faculty advisor before the student enrolls in FA4970.
Credits: variable to 3.0
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

Social Sciences

SS 1001 - Orientation to the Social Sciences

Introduction to departmental requirements, relevant university resources, careers in social sciences and history, skill expectations, and portfolio development; assessment of current knowledge.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Sustainability Sci and Society, Social Sciences, Anthropology, History

SS 1002 - Introduction to Law and the Legal Practice

An introduction to how one becomes an attorney, what it is like to be an attorney, and the career options available to attorneys.
Credits: 2.0
Lec-Rec-Lab: (2-0-0)
Semesters Offered: Spring, in odd years

SS 1500 - Introduction to History

An introduction to issues of historical causation, argumentation, positionality, and evidence through examples from various periods and times, mainly in American history. Students will examine how history is done, what gets preserved, and explore how it it interpreted, using numerous lenses including narratives, digital history, and material culture.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

SS 2001 - Introduction to Social Science Research

Students are introduced to various social science research methods and design. Covers scientific reasoning, developing questions, sampling, ethics, and quantitative and qualitative data collection using experiments, content analysis, survey, interview, oral history, statistics, GIS, comparative analysis, and archaeology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

SS 2050 - Fundamentals of Geographic Information Systems and Technologies

Introduction to geospatial sciences and technologies that are widely used for mapping and analyzing geographic patterns of human activities. Students gain hands-on experience in data collection, spatial data editing, georeferencing, spatial analysis, cartography, and spatial problem solving.
Credits: 3.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall, in even years, Spring, in even years

SS 2100 - Introduction to Cultural Anthropology

Introduction to the field of cultural anthropology with a focus on human diversity, patterns of culture and human organization, globalization, and social change.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SS 2200 - Introduction to Archaeology

Introduction to the methods of archaeology and the contributions of the discipline to understanding of world prehistory. Topics include the ways archaeologists discover and excavate sites, the analysis of archaeological artifacts and features, human evolution, and the patterns of world prehistory.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

SS 2210 - Community Development and Planning

This introductory course will explore questions by examining the physical, social, and spatial systems that influence how and where we live, work, and play in the ever-changing industrial and post-industrial city.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years

SS 2300 - Environment and Society

Examines social approaches to understanding why environmental problems happen and how environmental problems are resolved. Includes concepts such as sustainability, market-based environmental policies, property systems, and environmental justice. Case studies may include biodiversity, deforestation, climate change, water quality, and toxics.
Credits: 3.0
Lec-Rec-Lab: (2-1-0)
Semesters Offered: Fall, Spring, Summer

SS 2400 - Introduction to Human Geography

This course introduces students to concepts, problems, and case studies that make up the study of human geography: the spatial differentiation and organization of human activity, environmental sustainability, and the role of space and place in our everyday lives.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SS 2450 - Introduction to Sustainable Tourism

An introduction to core travel and tourism concepts and sustainable tourism practices and policies. Focus will be upon critical comparison of tourism impacts and the conceptualization of their own sustainable tourism experience.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years, Spring, in even years

SS 2500 - United States History to 1877

This broad historical survey will examine the social, political, and economic development of North America and the US from initial human settlement through the civil war.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SS 2501 - United States History Since 1877

This broad historical survey will examine important intellectual, political, and social changes and events in the United States over the course of the twentieth century and beyond, representing the perspective of a wide variety of diverse individuals and groups.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

SS 2502 - European History to 1650

A survey of the history of Europe from the Archaic Greek period to 1650. Covers political, social, intellectual, religious, economic, and artistic developments of the European continent.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand

SS 2503 - European History Since 1650

A survey of the history of Europe from the mid-seventeenth century to the present. Covers political, social, intellectual, religious, economic, and artistic developments on the European continent.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand

SS 2504 - World History to 1500

An introduction to the basic themes and content of world history from antiquity to 1500 CE.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years, Spring, in even years

SS 2505 - World History Since 1500

Survey of world history from 1500 CE to the present. Traces the evolution of different societies from around the world, emphasizing exchanges, interactions, and conflicts that produced global change.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years, Spring, in odd years

SS 2510 - Gender and the Past

This course has two main goals: to explore the relationship between gender in the past and present; and to evaluate the actual empirical evidence that speaks to people's gendered lives in many times and places.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years

SS 2600 - American Government & Politics

Outlines the principles and logic of American Government and politics and explores contemporary issues in national and state government.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring

SS 2610 - Introduction to Law and Society

Examining the civil and criminal justice system to explain how law informs yet is shaped by political, economic, and social forces. This course covers issues such as individual rights, the jury system, tort law, legal reform movements and constitutional interpretation.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SS 2620 - Introduction to Public Policy

Introduction to key public policy and public management concepts and issues.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SS 2625 - Introduction to American Foreign Policy

This course offers a general introduction to American foreign policy formulation and execution. It considers how US foreign policy institutions function to address current foreign policy challenges. The goal of this course is to provide students with the tools for understanding America's place in the world and its foreign relations.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall

SS 2635 - Comparative Politics

Study of the government and politics of non-U.S. countries. Covers parliamentary, authoritarian, and presidential systems. Some attention to politics of the European Union.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years, Spring, in even years

SS 2700 - Introduction to Sociology

Introduces students to the way that sociologists think about different components of society. Topics include the family, religion, markets, organizations, political systems, and educational systems. Also covers the source of individual values, beliefs, and attitudes.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring

SS 2720 - Statistics for Social Science

Introduces students to quantitative analysis of social phenomena. Emphasizes understanding and proper interpretation of graphs; data quality; measures of central tendency, dispersion, and association; the concept of statistical significance; and interpretation of basic OLS regression. Introduces statistical software.
Credits: 4.0
Lec-Rec-Lab: (3-0-2)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following College(s): College of For Res & Env Sci, College of Sciences & Arts, College of Business
Pre-Requisite(s): MA 1020(C) or MA 1030(C) or MA 1120(C) or MA 1031(C) or MA 1032(C) or ALEKS Math Placement >= 61 or ACT Mathematics >= 22 or SAT MATH SECTION SCORE-M16 >= 540

SS 2750 - Contemporary Racial Inequality in the United States

This course provides a social science overview of issues of race, inequality, and social justice in America. Topics will include the idea of race and the history of race relations, understandings of the economic, political, and cultural causes and consequences of racial inequality, and the study of social movements to address racial inequality.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand

SS 2801 - Introduction to Global Climate Change

Causes, consequences, and solutions to the issue of global climate change. Focus on evaluating potential solutions to problems arising from climate change. Intended to provide students from diverse academic backgrounds with an understanding of the issue and to provide multidisciplinary context for students pursuing further study of climate change.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring

SS 3090 - Undergraduate Program for Exploration and Research in Social Sciences (UPERSS)

An undergraduate research experience for students to work with a faculty mentor to undertake research, creative work, or community-based project. The student typically signs up for 1-3 credits per semester. Requires GPA of 2.5 or higher.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of instructor required

SS 3105 - Native American and Indigenous Communities

Exploration of contemporary Native American and Indigenous communities worldwide, using a cross-cultural and comparative approach, with some historical context. Topics examined include the legacy of settler colonialism, issues facing Indigenous communities today, and Indigenous renewal and resistance, with emphasis on Native North America.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3110 - Food Systems & Sustainability

Compares the embedded nature of culturally defined food production and consumption habits: the crux of nature meeting and mixing with culture. The course features classic food system scholarship as well as emerging topics and contemporary case studies.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015

SS 3200 - Archaeology of the Modern World

Introduction to historical archaeology. Topics include the methods of historical archaeology, theoretical approaches, and sources of evidence. Emphasizes archaeological contributions to understanding of the American past, and the contributions of historical archaeology to an alternative view of American history and culture.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3210 - Field Archaeology

Practical experience and training in the methods and techniques of field archaeology. Selected readings are followed by active participation in site survey, testing, excavation, record keeping, and analysis. Students benefit through involvement in ongoing research projects.
Credits: variable to 8.0; Repeatable to a Max of 8
Semesters Offered: Summer
Pre-Requisite(s): UN 1015

SS 3221 - Archaeological Sciences

Introduction to the archaeological sciences, including geo/bioarchaeology and materials science. Course emphasizes connections between field and laboratory, and scientific and environmental perspectives on the world's peoples and cultures, both ancient and industrial.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Co-Requisite(s): SS 3222

SS 3222 - Archaeological Sciences Laboratory

Using hands-on exercises and project-based learning, labs include identification, analysis, and stabilization of metals, ceramics, and organics from archaeological contexts, and include elements of geo- and bioarchaeology, and materials science.
Credits: 1.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Fall, in even years
Co-Requisite(s): SS 3221

SS 3225 - Capitalism and the Modern World

This course explores from an anthropological perspective themes concerned with the increasing interconnectedness of world cultures and economies after 1400. Focusing on Western expansion and the establishment of global networks in the Modern Era and tracing the social, political, and economic interactions that have shaped our contemporary world.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): UN 1015

SS 3230 - Archaeology of Industry

The study of industrial heritage using archaeological and historical perspectives. Covers theories, methods, and techniques by means of lectures, readings, and case studies. Students conduct original research, generally on Copper Country industrial sites, under the guidance of the instructor.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): SS 2200 and UN 1015

SS 3240 - Reading the Landscape: Anthropology, Geography, History

Landscape is a lens through which scholars study people, environment, and place. The concept transcends traditional disciplinary boundaries. Students will read and discuss different approaches to landscape, with special focus upon anthropological, geographic, and historical perspectives.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): UN 1015

SS 3250 - Biological Anthropology

A human evolution course focusing upon a summary of general bio - anthropological principles of evolutionary change, the current fossil record evidencing human evolution, and the consequences of human evolutionary change for modern human variability, health, and behavior.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 1015

SS 3260 - Latin American Cultural History

This course examines the diverse, but interconnected, cultures of Latin America. The class will examine the sources and patterns of particular cultural traditions, while at the same time understanding the trajectory of social, political, and economic transformations throughout the region.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3270 - Archaeology of the African Diaspora

Forced into slavery, the 'scatterlings' of Africa adapted and struggled to thrive in the New World. Archaeologists studying the Diaspora generally examine: ethnogenesis and blending of identity, migration, structural inequalities, and the construction of race and racism.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Summer
Pre-Requisite(s): UN 1015

SS 3315 - Population, Health, and Environment

This course investigates relationships between the world's population, population change, population distribution, resource consumption, and environmental, health, and social consequences. Addresses local and global relationships and the population processes (mortality, fertility, and migration) involved.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3420 - Imaginary Worlds: Geographies of Science Fiction and Fantasy

Connects topics from human, physical, and environmental geography to relevant work in science fiction and fantasy, how popular culture shapes understandings of nature and place, and how geography is used in media to exert and challenge power.
Credits: 3.0
Lec-Rec-Lab: (2-0-1)
Semesters Offered: Spring, in even years
Pre-Requisite(s): UN 1015

SS 3501 - Making History: Historical Research and Writing

Learn how and why historians examine the past, and how they craft stories about it for readers. Emphasis on disciplinary approaches and philosophies of history. Students will practice research skills with archival, oral, and digital sources, and apply them in written, oral, and online work products.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3505 - Military History of the U.S.

History of the American military and its place in American society in both peace and war from the colonial period until the present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3510 - History of American Technology

Survey of the technological changes that transformed a rural, agrarian America into an urban, industrialized nation. Focuses on how America's social values and geographical situation influenced the direction taken by its technology and engineering community and how America's industrialization, in turn, had significant effects on American society.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3511 - History of Science in America

Examines the development of scientific enterprises in the U.S. from the colonial period through the present day. Emphasizes institutional bases of science and the place of scientific activities within American society.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3513 - History of Making Things: Craft and Industry in America

Examines historical relationships between skill, tool use, embodied knowledge, and the design process in America from the colonial era to today. Includes production techniques, distribution systems, technological changes, industrialization, post-war globalization, and current craft and design.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3515 - History of American Architecture

Survey of North American architecture from prehistoric times to the present. Focuses on principal architectural styles, building types, and construction technologies. Also examines ideas about architecture to understand the American past.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

SS 3520 - U.S. Environmental History

Examines how human interaction with physical environment has changed in North America over the last four centuries. Topics include uses of land by Native Americans, changes associated with European colonization, incorporation of natural resources into industrial economy, early conservation and preservation movements, and environmental concerns accompanying urbanization and industrialization.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3530 - The Automobile in America

Examines the automobile in diverse ways, seeing it as a complex product to be manufactured, as a stimulus to reshaping the environment, as an object that has altered social behavior, and as a problem solver and problem maker.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, Summer
Pre-Requisite(s): UN 1015

SS 3535 - History of Privacy

Privacy has been a defining characteristic of human experience since ancient times. But what is privacy? Students will interrogate the experiences, meanings, and definitions of privacy throughout history. The thematic structure of this course will allow students to explore the question of 'what is privacy' through a variety of disciplinary lenses.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3540 - History of Michigan

The history of Michigan from before European settlement to the present.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3541 - The Copper Country

Examines the social, labor, and technological history of the Copper Country from the frontier era until the shutdown of the mines.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Summer
Pre-Requisite(s): UN 1015

SS 3542 - History of Detroit

An exploration of the social, cultural, political, and economic history of Detroit from the era before European contact through the present. The course will combine lectures, discussion, activities, examinations and an analytical essay in order to investigate the history of Detroit from a variety of perspectives.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3552 - Renaissance & Reformation

The history of Europe from 1300 to 1650.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3560 - History of England I

The social, economic, and political history of England from Stonehenge to 1750.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3561 - History of England II

History of England from 1750 to the present, including political, social, and economic developments in the period of Britain's greatest influence in the world.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3580 - Technology and Society in History

An exploration of the history of technology and society. The course looks at ways technology influenced development of civilization and ways societal values of civilization have conditioned technology.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3581 - History of Science

A survey of the development of scientific ideas (abstractions about how nature is and behaves) from the Greeks to the modern world, including major physical and life science revolutions by natural philosophers like Copernicus, Galileo, Darwin, and Einstein.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3612 - International Relations

An introduction to the field and study of International Relations (IR). This course will cover major IR theories and current topics in global politics including: globalization, terrorism, human rights, and environmentalism.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3621 - Non-Profit Management

Key public policy and public management concepts are introduced and applied to the student's field of interest.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

SS 3625 - Policy Analysis

This course provides students with a working knowledge of how public policy decisions are made, the policy analysis tools that support decisions, and practice applying the knowledge to conduct a policy analysis project.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SS 2620(C) and SS 2001(C) and (PSY 2720(C) or MA 2720(C) or SS 2720(C))

SS 3626 - STEM Policy Lab at MTU

Students will participate in policy lab setting engaging in stakeholder collaboration and experimentation to address pressing societal issues in STEM.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring

SS 3630 - Environmental Policy and Politics

A broad survey of how environmental policy making actually works in the U.S. Covers both environmental policy processes and politics, and the major environmental policies themselves for control of air pollution, water pollution, hazardous wastes, and other major environmental problems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3640 - Selected Topics in Cyber-Law

Applies legal and ethical principles to evolving computer technology. Explores current legal issues such as surveillance, privacy, free speech, crime, encryption, on line contracting, intellectual property and censorship, as well as legislative efforts to resolve these and other computing dilemmas.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3650 - Intellectual Property Management

Covers principles of intellectual property law, addressing managerial and policy issues in copyright, trademark, trade secret, and patents. Readings and discussions also cover how these property and legal systems impact the balance between property exclusivity, technological innovation, and public access.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3660 - Constitutional Law

Introduces the U.S. Constitution and how it has been interpreted by the Supreme Court over time. Explores historical, social and political consequences of major constitutional themes such as federalism, judicial review, and evolving view of individual rights and liberties.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3661 - Civil Rights & Civil Liberties

Seminar focused on the rights and liberties guaranteed by US Constitutional amendments. Students learn constitutional theory and interpretation on topics of privacy, speech, media, religion, criminal justice, and gender/ethnic equality. Constitutional Law I is not required.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3665 - Crime, Incarceration, and Social Policy

Explores criminal and social justice policies including policing and control of crimes involving violence, drugs, sexual offenses, and terrorism. Sentencing, effects of mass incarceration, and inequalities based on race and class will also be examined in student writing and debate.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): UN 1015

SS 3750 - Social Inequality

A critical assessment of social and cultural processes associated with group-based or categorical patterns of inequality. Examines the creation, persistence, and attempts at reduction of structured inequality based on categorical factors such as social class, race, ethnicity, and gender. May explore other significant sources of social inequality.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years, Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3755 - Sustainability and the Private Sector

This course provides an overview of corporate social responsibility (CSR), and how it is being implemented with particular consideration for interaction with government and the non-profit sector.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

SS 3800 - Energy Policy and Technology

This course examines the policies and technologies affecting the production, transportation, and use of energy. It focuses on U.S. domestic energy policy and places it in the context of the global energy system. The course aims at providing a holistic view of energy systems connecting technological options with societal and environmental concerns.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3801 - Science, Technology, & Society

Examines the relationship between science, technology, society, and the environment. Topics may include effects of technologies such as computers, biotechnology, and chemicals on society and nature, science and technology policy, and the history of technology and its global consequences.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3805 - Environmental Justice

This course focuses on the histories, theories, and practices of environmental justice in local, national, and global contexts. Topics to be explored include environmental racism, industrial facility siting, sustainable development, as well as food, energy, and climate justice.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): UN 1015

SS 3811 - Energy Security and Justice

This course focuses on concepts that are fundamental to energy policy: energy security and energy justice. It introduces students to the three main views of energy security (supply, demand, and energy services). In addition, the course provides a critical perspective of evaluating energy decision-making through the lenses of justice.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): UN 1015

SS 3815 - Energy and Society

Course examines the role of energy in society by exploring energy infrastructure, consumption, technology, their implications for social systems and human impacts on the natural world, and the problems and potential solutions in intertwined energy and social systems.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Summer, in odd years
Pre-Requisite(s): UN 1015

SS 3913 - Sustainable Living Practicum

Practice, evaluate, and reflect on ways to live sustainably in daily life with a particular focus on campus. Planning and evaluating activities for continual improvement and sustainability self reflections are core tasks. Students serve as sustainability leaders for MTU and beyond.
Credits: variable to 2.0; May be repeated; Graded Pass/Fail Only
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

SS 3915 - Experiencing Museums

Hands-on experiential course includes field trips to museums and historic sites with emphasis on career development in the heritage sector. Critical thinking about the history of museums and their current economic impact will be included.
Credits: 3.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 3920 - Topics in Anthropology/Archaeology

Survey of a major branch of American anthropology or archaeology, or a specific time period or region. Topics may include North American prehistory, experimental archaeology, applied anthropology, economic anthropology, or other specialized themes. Readings will emphasize both theoretical and substantive contributions. May be repeated if topics differ.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

SS 3950 - Topics in American History

Examines an important theme, topic, or era in the development of American society, ranging from the colonial era up to the present. May include such topics as the Vietnam War, sports in America, American vernacular architecture, or urban America, all from a historical viewpoint. May be repeated if topic differs.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3951 - Topics in European History

Examines important themes, topics, or eras in European history, from late Antiquity to the present. Topics may include intellectual history, revolutions, monarchy, military history (incl. the Crusades), or migrations. May be repeated if topic differs. See department for current offering.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3952 - Topics in World History

Examines major ideas, processes, and events in world history. Topics may include trade and commodities, imperialism, slavery, migration, or other subjects with transnational significance. May be repeated if topic differs
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 3960 - Cultural Immersion

Course designed for students on supervised study abroad or exchange programs in which they investigate and report on cultural patterns and behaviors.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Pre-Requisite(s): UN 1015

SS 3961 - Preparing for Cross-Cultural Immersion Experiences

Preparation for study abroad, service learning, and cross-cultural research or internships. Students reflect on their cultures; explore how to live and work effectively with other cultural groups, discuss cross-cultural professional ethics; and practice collecting and analyzing data from cross-cultural, immersive field work.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

SS 3990 - Topics in the Social Sciences

Examines an important theme or topic in the social sciences, such as social theory, work and society, or the engineer in American society. May be repeated if topic differs.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 4000 - Independent Study

Independent study of topic of special interest with assistance and supervision from appropriate faculty.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

SS 4001 - Social Thought

An intensive survey of the literature of 19th-20th century history of social thought, including the writings of Marx, Durkheim, Weber, and other prominent anthropologists, sociologists, and political philosophers.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 1015

SS 4009 - Introduction to Survey Methodology

A general introduction to survey methods. Students will learn the basics of survey design from questionnaire construction to the measurement of complex social science concepts. Students will also demonstrate their ability to conduct an original survey through a class project.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

SS 4010 - Applied Statistics for the Social Sciences

Covers applied methods used in conducting empirical research in the social sciences. Topics include research design, hypothesis testing, measurement of concepts, and computer-based data analysis. Assumes familiarity with Social Sciences concepts.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SS 2720 or PSY 2720 or MA 2720 or BUS 2100

SS 4040 - Civic Communications

This applied course gives students practice producing professional communications for policymakers, community leaders, and other decision-makers - translating research for decision-making by writing policy briefs, creating infographics, visualizing data in charts, tables, and other graphics, and giving professional presentations to the public.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Pre-Requisite(s): SS 2001 and UN 1015

SS 4041 - Communication for Sustainability

Starting from the United Nations sustainable development goals, explores community-level sustainability challenges, potential solutions, and communication strategies to promote awareness and project support. Focuses on concepts such as sustainability, community-driven project development, and application of communication strategies.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): UN 1015

SS 4050 - Advanced GIS Methods and Projects

Advanced application of Geographic Information Systems in social sciences as a tool to collect and analyze qualitative and quantitative data. Students gain hands-on experience in data collection, advanced spatial analysis, and scripting.
Credits: 3.0
Lec-Rec-Lab: (1-0-2)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): (SS 2050 or FW 3540 or GE 3250 or GE 4540 or SU 3540 or SU 4010 or SU 4012) and UN 1015

SS 4101 - Energy and Climate Policy

This course will review the complex process of energy policy making in the U.S. focusing on political, economic, social, organizational, and technological dimensions. Students will examine the prospects for policy change in the light of global climate change.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

SS 4120 - Sustainable Development and Communities

Advanced anthropology course that focuses on cultural, social structural, historical, and environmental analyses of sustainable development. Students engage with relevant social theory and practical applications in sustainable development case studies.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Pre-Requisite(s): UN 1015

SS 4200 - Environmental Anthropology

A seminar on the study of culture and politics in marginal environments and disadvantaged communities. Draws upon research in anthropology and geography to examine the interaction in the Americas, Asia, Africa, Europe, the Pacific, and the Arctic.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SS 2100 and UN 1015

SS 4211 - Ethnographic Methods

Field-based course that surveys basic concepts of ethnography and applies them in a class research project. Provides practical experience in field observation, interviews, field notes, and write-up of research.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015

SS 4220 - Archaeological Thought in Society

This course explores themes concerned with the intellectual development of archaeology, including research methods, theoretical concepts, and problems that have characterized the history of the discipline. Particular emphasis is placed on the broader social contexts in which archaeology has developed.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

SS 4230 - Archaeological Analysis and Interpretation

Course focuses on how archaeologists mobilize material data to understand everyday life in the past. Discussion, exercises, and lab time are used to cover the goals of archaeology, nature of archaeological data, research design, sampling, typology, classification, database management, and quantitative and qualitative analytical methods.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Pre-Requisite(s): SS 2200

SS 4313 - Sustainability Science

This course covers the fundamental scientific concepts (dynamic systems and catastrophe theory) as they are applied to socioecological systems and the use of indicators and indices to track progress towards sustainability goals. Review of local, national, and global sustainability policies to avoid catastrophes and guide sustainable development.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 4390 - Seminar in Sustainability

This seminar in sustainability topics will cover a rotating set of topics, depending on semester offering. Topics may include energy use, justice, pollution, green design, or regulations bearing on sustainability.
Credits: 3.0; Repeatable to a Max of 9
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): UN 1015

SS 4400 - Environmental Sociology

Examines changing relationships between social systems (government, economy, etc.) and the environment. Explores the structural and cultural causes and consequences of such topics as production, consumption, population, energy systems, climate change, pollution, and environmental justice and how to respond to these issues through policies and actions.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: Must be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SS 2700 or SS 2400

SS 4420 - Memory and Heritage

Provides a broad and deep overview into the prevalent debates, cases, and methods within the transdisciplinary fields of memory and heritage studies; students apply these processes in collaborative and individualized cases. Memory work in post-violence and post-industrialization communities, politics, and performances will be framed globally.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years

SS 4450 - Sustainable Tourism and Planning

A sustainable and systematic approach and critique to tourism planning and development. Students assess issues of inequity, exploitation, and environmental impacts in tourism planning, modes of redress and resistance, and develop solutions in hypothetical and applied scenarios.
Credits: 3.0
Lec-Rec-Lab: (1-2-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): (SS 2450 or SS 2100 or SS 2400 or SS 2700) and UN 1015

SS 4501 - Senior Thesis

Directed study leading to production of a senior thesis for all social science majors.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SS 4630

SS 4502 - Historical Research

This course supports historical research in conjunction with any upper-division history seminar. Students must take both courses simultaneously, and will work directly with the instructor to produce an original research paper.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-1-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman

SS 4530 - Deindustrialization and the Urban Environment

This course examines economic, environmental, and social problems associated with deindustrialization in postwar North American cities and the strategies adopted to ameliorate them. Major topics include segregation and housing, environmental regulation, environmental justice, industrial heritage, and economic and urban development policy.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015

SS 4540 - Global Environmental History

This course explores changes in human interactions with earth systems over time, starting with the development of agriculture and continuing to the present. Case studies include mining, forestry, water, agricultural, sustainability, and urban development.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SS 3520 and UN 1015

SS 4550 - History of Technology

Advanced reading and discussion course focusing on the various ways in which we understand writing about the history of technology. This course provides the theoretical framework for research and writing in the field, and culminates in a major research project with primary source research as well as a required interpretive component.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): (SS 2500 or SS 2501 or SS 2502 or SS 2503 or SS 3510 or SS 3580) and UN 1015

SS 4551 - Industrial Communities

Introduces advanced students to scholarly literature on industrial communities and its methods through reading and discussion of selected articles and case studies. Students will acquire skills in oral history, archival, field, and community-based research.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

SS 4552 - Historical Archaeology

This course examines the relevance of archaeology and the varied approaches archaeologists use in examining our Modern World. How do archaeologists interpret the archaeological record and how do archaeological perspectives effect the questions, interpretations, and meanings we bring to understanding the past, the present, and the future.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

SS 4553 - Material Culture Studies

Advanced reading and research in material culture studies. Learn to interpret the cultural and historical meanings in physical objects such as tools, housewares, memorials, furniture, etc. Emphasis on American craft, industry, and deindustrialization. Methodologies from archaeology, American studies, museum studies, public history, art history, etc.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): SS 3513

SS 4554 - Global Industrial History

Seminar exploring histories of industrialization around the world. Covers key theoretical debates and uses different methodological approaches in case studies of selected industrial topics and themes.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

SS 4600 - Industrial and Historical Archaeology

This course is an advanced exploration of the industrial past using archaeological perspectives. It is a seminar combining scholarship from different fields and using material evidence to examine the evolution of work and production in industrial society.
Credits: 3.0
Lec-Rec-Lab: (0-0-3)
Semesters Offered: Spring, in even years
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SS 2200 or SS 3200 or SS 3230 or SS 3270

SS 4610 - Cultural Resource Management

Introduces the field of cultural resource management (CRM) archaeology; the legal structure that underwrites its practice; the real-world implications for the CRM process; practical problems faced by archaeologists in preservation fields, and the legal, political, and ethical obligations they have to various constituents and communities.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): SS 2100

SS 4625 - Program Evaluation for Sustainable Development

Introduces students to the common tools and methodologies used in evaluating the social impacts of public programs, The course utilizes applied examples from a range of sectors, including healthcare, social welfare, an environmental policy. Students learn how evaluation is crucial to sustainable and effective policy making.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): SS 2720 or MA 2720 or PSY 2720

SS 4630 - Advanced Research in the Social Sciences

Capstone course for students to develop an original social science thesis research project in the areas of History, Anthropology, Law, Sociology, or Sustainability. Students will prepare a proposal for a senior research project or thesis.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

SS 4700 - Communities and Research

A rural sociology course analyzing the sustainability of rural communities (socially, environmentally, economically, and culturally). The course involves participatory research conducted together with a local community organization. Students practice research skills while making a difference in improving community life.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore
Pre-Requisite(s): UN 1015

SS 4710 - Geographies of Migrant Communities

Covers the geographies of ethnic identity and nationalism, national identity and territory, borderlands and diasporas, national separatism and the variety of ways in which cultural difference asserts itself.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): UN 1015

SS 4850 - Documentation of Historic Structures

Principles and practice of survey and documentation of historic structures. Techniques include reconnaissance survey, in-depth survey, measured drawings, architectural photography, primary research, and written analysis. Students use survey and documentation to analyze historic structures.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 4900 - Seminar in Social Sciences

An intensive seminar study of a topic of importance and special interest in the social sciences. Topics could focus on the history of anthropological theory or on world religious systems in comparison. May be repeated if topic differs.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 4910 - Professional Development for the Social Sciences

Assessment of learning and preparation for post-graduate work, professional training, or graduate school.
Credits: 1.0
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Sustainability Sci and Society, History, Social Sciences, Anthropology, Policy & Community Development; May not be enrolled in one of the following Class(es): Freshman, Sophomore

SS 4915 - Effective Social Action: Supporting Local Justice, Policy and Cultural Initiatives

Students will work directly with a community organization that provides legal, social, or cultural resources through engagement in a project identified by that organization. Weekly class sessions to focus on related challenges such as engaging constituencies, marketing and funding community services for low income and/or rural populations.
Credits: 3.0; Repeatable to a Max of 6
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman

SS 4920 - Internship Experience

Internship, on or off campus, providing appropriate practical, professional experience in an area related directly to a student's course of study. Students work under professional supervision. Requires a written evaluation of the work.
Credits: variable to 9.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: Permission of department required

SS 4921 - Washington Internship - Professional Practicum

Students participate in a colloquium in Washington D.C., offered as part of an academic internship program, that includes a range of prominent speakers, information interviews, and a capstone reflection. This course will have a program fee attached that is equal to the room and board fee charged by the Washington Center.
Credits: variable to 3.0
Semesters Offered: On Demand
Restrictions: Permission of department required
Pre-Requisite(s): UN 1015

SS 4922 - Washington Experience Topics

Students take an academic course that is offered as part of an academic internship program in Washington D.C., with offerings including courses in American history and government, international affairs, and law.
Credits: variable to 3.0
Semesters Offered: On Demand
Restrictions: Permission of department required

SS 4990 - Independent Study in Anthropology

An original study of an anthropological problem, including literature search, data collection, and analysis, culminating in a research report.
Credits: variable to 3.0
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; Must be enrolled in one of the following Class(es): Senior
Pre-Requisite(s): UN 1015

SS 4995 - Topics in the Social Sciences

Examines an important theme or topic in the social sciences, such as social theory, work and society, or the engineer in American society. May be repeated if topic differs.
Credits: variable to 3.0; Repeatable to a Max of 9
Semesters Offered: On Demand
Restrictions: May not be enrolled in one of the following Class(es): Freshman

Surveying

SU 1000 - Introduction to Geospatial Engineering

Introduction to the geospatial engineering profession with emphasis on technology and careers. Topics include: technology, specialties, education, professional practice, life-long learning, and ethics related to geospatial engineering.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Surveying Engineering, Geospatial Engineering

SU 2000 - Introduction to Surveying

An introductory course exploring surveying instruments and their use in the measurement of angles, distances and elevations. Subject areas apply mathematics, fundamentals of mapping, computational methods, measurement analysis and proper instrument care in plane surveying.
Credits: 2.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Fall, Spring

SU 2050 - Geospatial Computations

Course covers the methods and techniques to observe, analyze and report field measurement data through surveying applications. Topics include horizontal and vertical control, survey data reduction, computations, computer applications, and coordinate geometry.
Credits: 4.0
Lec-Rec-Lab: (0-3-3)
Semesters Offered: Fall
Pre-Requisite(s): SU 2000(C)

SU 2220 - Route and Engineering Surveying

Study of the geometry and computations utilized in the design and construction of roads and highways. Topics include horizontal, spiral and vertical curves, alignments, centerline profiles/cross sections, grades, earthwork quantities and mass diagrams.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): SU 2050 or SU 2000

SU 3110 - Surveying Field Practice

Field to finish survey projects using current surveying instrumentation and software. Field applications include: Cadastral, topographic, as-built, quantity, construction layout, ALTA, and control surveys.
Credits: 4.0
Lec-Rec-Lab: (0-2-6)
Semesters Offered: Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 2220 and SU 2050

SU 3180 - Boundary Surveying Principles

Interpretation of property descriptions used to establish land boundaries. Resolving conflicts in boundary descriptions as well as conflicts in evidence. Review doctrines pertaining to transferring title and the role of the surveyor in issuing opinions on boundary location in boundary disputes.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 2000

SU 3600 - Surveying Computations and Adjustments

Basic computations and analysis of surveying measurements by adjustment theory are introduced. Students will gain the ability to use computer software to perform the computations. Analysis of measurements and errors based on statistical principles and least squares principles will be discussed.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall
Pre-Requisite(s): SU 2050 and (MA 2320 or MA 2321 or MA 2330) and MA 3710(C)

SU 4010 - Geospatial Concepts, Technologies, and Data

High level review of geospatial data acquisition systems, sensors, and associated processing technologies. Course considers geospatial metadata generation principles, interoperability, and major tools for manipulation with geospatial data. Course may help in transition of non-geospatial majors to geospatial field.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Major(s): Integrated Geospatial Tech, Surveying Engineering, Geospatial Engineering

SU 4011 - Cadastre and Land Information Systems

Topics include: an introduction to land rights, land ownership, lease, and traditional rights, mortgaging and land as capital, description of land rights, boundary description, land information systems, examples of cadastre types over the globe, and modern technical aspects.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Fall

SU 4012 - Geospatial Data Mining and Crowdsourcing

This course comprises theory and applications of geospatial data mining. Typical application scenarios are covered. Attention is given to open-source data and systems crowdsourcing, as well as social media. Special focus on imaging and visual analytics.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Spring

SU 4013 - Hydrographic Mapping and Surveying

This course comprises theory and applications of hydrographic mapping technologies. Typical application scenarios are covered. An intensive lab component provides hands-on experience in hydrographic data processing and visualization.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Spring

SU 4060 - Geodesy

Introduction to geometrical and physical geodesy. Examines computations on the ellipsoid, elements of datums, map projections, and state plane coordinate systems.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 2050 and (MA 2320 or MA 2321 or MA 2330) and MA 2160

SU 4100 - Geodetic Positioning

Introduces the theory and practice of global positioning systems, primarily global navigation satellite systems (GNSS). Examines data collection, quality assessment, analysis and adjustment.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 4060 and SU 3600(C)

SU 4140 - Photogrammetry & UAV Mapping

Basic principles of photogrammetry and its role as a technology for spatial data collection. Use of photogrammetry in the fields of surveying, engineering, and geographic information management will be discussed.
Credits: 4.0
Lec-Rec-Lab: (0-3-2)
Semesters Offered: Fall

SU 4142 - 3D Surveying and Modeling with Laser Scanner Data

Theory and application of terrestrial LIDAR scanning. Typical application scenarios are also included. Intensive lab component provides hands-on experience in LIDAR point cloud processing and visualization.
Credits: 3.0
Lec-Rec-Lab: (0-2-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Class(es): Senior

SU 4180 - Land Subdivision Design

Introduces aspects of land use within the framework of state and local regulations of land divisions for development. Additional topics include: legal principles, preparing land descriptions, state surveying laws, rules, ethics and professional conduct.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior
Pre-Requisite(s): SU 3180 and (CMG 3200 or SU 3210)

SU 4300 - Geospatial Monitoring of Engineering Structures and Geodynamic Processes

Course comprises methods and applications of geospatial monitoring technologies. Typical application scenarios are presented in this course. Course has a number of labs which allow students to get a hands-on experience in processing and modeling monitoring data.
Credits: 3.0
Lec-Rec-Lab: (2-0-2)
Semesters Offered: Fall
Restrictions: Must be enrolled in one of the following Major(s): Integrated Geospatial Tech, Surveying Engineering, Geospatial Engineering
Pre-Requisite(s): SU 2000 or SU 2050

SU 4540 - Introduction to Remote Sensing

Introduction to the principles of image formation, electromagnetic spectrum, imaging systems, photo interpretation and image classification using image analysis software.
Credits: 3.0
Lec-Rec-Lab: (0-2-1)
Semesters Offered: Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior
Pre-Requisite(s): SU 2050

SU 4601 - R for Geosciences in Applied and Fundamental Tasks and Research

R for Geosciences is intended to build up modern engineers and scientists and to get them acquainted with a powerful tool for the solution of miscellaneous applied statistical tasks in geosciences.
Credits: 3.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: On Demand

SU 4900 - Capstone Design Project

An engineering design project which integrates multiple aspects of previous surveying coursework while working with an industry partner. Includes project description, project planning, field work, office analysis, computer-aided design, final project completion and oral presentation skills.
Credits: 3.0
Lec-Rec-Lab: (0-2-3)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Surveying Engineering; Must be enrolled in one of the following Class(es): Senior

SU 4996 - Special Topics in Geospatial Technologies

Selected additional topics of interest in Geospatial Technologies based on student and faculty demand and interest. May be a tutorial, seminar, workshop, project, or class study.
Credits: variable to 4.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Surveying Engineering; Must be enrolled in one of the following Class(es): Senior

SU 4997 - Independent Study in Geospatial Technologies

Independent study of an approved topic under the guidance of a Surveying Engineering faculty member. May be either an academic, design, or research problem/project.
Credits: variable to 3.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Surveying Engineering, Geospatial Engineering; Must be enrolled in one of the following Class(es): Senior

SU 4998 - Undergraduate Research in Geospatial Technologies

An undergraduate research experience in Geospatial Technologies. Under the guidance of a Surveying Engineering faculty member, students work on a selected/approved research problem or work directly with faculty on active research projects/grants. May require more than one semester to complete.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required; Must be enrolled in one of the following Major(s): Surveying Engineering, Geospatial Engineering; Must be enrolled in one of the following Class(es): Senior

SU 4999 - Professional Practice Review

A review of the elements of the NCEES Fundamentals of Surveying examination, utilizing on-line quizzes, as well as administering the Michigan Tech Surveying Engineering Exit Exam. Course taken in final semester only.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Class(es): Junior, Senior

Theatre

THEA 1000 - Theatre Appreciation

Students engage theatre as a phenomenon precipitating experiences affirming life and sparking insight. Exploration of creativity comes through play writing; critical thinking is practiced in analyses of scripts and recorded performances, and learning key moments in theatre history. Aesthetics and production roles are applied through role projects showcasing directing, acting, set, lighting, props, costume, makeup/hair, sound, and dramaturgy.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring

THEA 1001 - First Year Arts Seminar

An active and discussion driven introduction to the arts as a profession. This course will set you up to get the most out of your Michigan Tech education, exploring fundamental foundations of artistic practice and how they apply to a myriad of connected industries.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

THEA 1110 - Entertainment Technology I

Overview of the basic technical techniques, theories, and terminology for the entertainment industry, including theatre. Focuses on practical application of stagecraft and rigging for a theatrical production, safety in technical theatre, physical theatre structures, production processes, and theatre organization.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

THEA 1120 - Lighting Technology I

Overview of the basics of entertainment lighting, stage electrics, and techniques for theatrical production. Focus on practical application of static and automated lighting for a theatrical production, including instrumentation and control.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

THEA 1130 - Costume Technology I

Introduction to basics of costume shop technology, costume construction/sewing. Focus on costume shop procedures, practical use of tools, machines, and techniques through individual projects. Overview of hand sewing and pattern fitting/alteration.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring

THEA 1140 - Foundations in Entertainment Design

Explores creation, development and communication of design for theatre, museums, galleries, zoos, community centers, art installations and specialty projects. Students practice collaboration design development, model making, rendering, and hand drafting, as they develop immersive experiences for a variety of venues.
Credits: 3.0
Lec-Rec-Lab: (0-0-4)
Semesters Offered: Fall

THEA 1170 - Voice and Movement

Students work to develop stronger, more vibrant and articulate speech, including vocal projection for the stage. Students will also develop physical flexibility and strength, beginning with discovery of the body's physical center. The student will also learn to create distinct physical characterizations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): UN 1015

THEA 1400 - Acting I

Teaches basic techniques of acting to include script and character analysis, internal and external approaches to performance, and basic use of voice and body.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall

THEA 2000 - Readings in Dramatic Literature

An examination of dramatic literature with an emphasis on theatre production. Students will examine a selection of plays each semester. Students can repeat the course up to four times; each semester examines different plays.
Credits: 1.0; Repeatable to a Max of 4
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Spring, Summer, in odd years
Restrictions: Must be enrolled in one of the following Major(s): Technical Theatre, Sound Design, Audio Production & Technology, Theatre & Entertain Tech (BS), Theater Arts, Theatre & Electr. Media Perf.; May not be enrolled in one of the following Class(es): Freshman

THEA 2110 - Entertainment Technology II

Focus on construction and the variable applications of stagecraft, rigging, and production processes with attention to safety and typical structures for the entertainment industry.
Credits: 3.0
Lec-Rec-Lab: (0-1-2)
Semesters Offered: Spring, in even years
Pre-Requisite(s): FA 1701 or THEA 1110

THEA 2111 - Stage Properties - Designing and Crafting

A focus on the design, research, production, and management of stage properties including: script, analysis, period and style, appropriateness, set dressing. Development and utilization of effective tools, materials, and techniques for structure, details, and finishing.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): FA 1701 or THEA 1110(C)

THEA 2120 - Lighting Technology II

A practical overview of the pre-production and technical process of installing and programming a lighting design.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): THEA 1120

THEA 2130 - Costume Technology II

Research and exploration of the theatrical techniques used to create costume crafts and personal props. Practical projects will challenge students to develop skills in areas such as millinery, leatherwork, painting and dyeing, fabric manipulation, mask making and jewelry, as well as the safe use of materials.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years
Restrictions: Permission of instructor required

THEA 2310 - Drafting for the Entertainment Industry

Introduction to drafting conventions and standards by the entertainment industry. Focus on technical and design techniques using CAD for communication through: ground plans, elevations, sections, detail drawings, orthographic projections, system diagrams, and 3D representations.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Pre-Requisite(s): UN 1015

THEA 2330 - Makeup for the Entertainment Industry

A practical guide to the theory and practice of makeup in the entertainment industry. Students will study basic techniques including corrective, aging, character makeup, and special effects.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years

THEA 2470 - Voice Acting Fundamentals

Introduction to recording, editing and mixing audio and video for different genres of voice acting and an exploration of hiring entities in the voice acting industry. Students will learn the basics of reading copy for various genres, and finding materials for producing auditions.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand, in even years
Pre-Requisite(s): UN 1015

THEA 2600 - Acting Practicum

Performance in a stage production or electronic media project. The project must be approved by the instructor either through audition or written contract of planned project.
Credits: 1.0; May be repeated
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

THEA 2610 - Entertainment Technology Practicum

Open to students selected for the crew of an entertainment production sponsored by the Department of Visual and Performing Arts. Positions on stage crews are open to all MTU students. Work assignments will be made by the technical director of the Department of Visual and Performing Arts.
Credits: variable to 3.0; May be repeated
Semesters Offered: Fall, Spring

THEA 2663 - Career Development: Theatre

Provides students the opportunity to attend professional events which contribute to the development of their careers. Students will experience seminars, workshops, performance opportunities, competitions, and may perform services and interact with professionals at such events as KCACTF and USITT.
Credits: 1.0; Repeatable to a Max of 6
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Major(s): Sound Design, Theatre & Entertain Tech (BS), Theatre & Electr. Media Perf., Audio Production & Technology

THEA 2690 - Dramaturgy Practicum

Practical experience in theatre productions researching and analyzing scripts and relevant topics to enrich the theatrical experience for both producer and audience.
Credits: 1.0; Repeatable to a Max of 3
Lec-Rec-Lab: (0-0-1)
Semesters Offered: On Demand
Restrictions: Permission of instructor required

THEA 3110 - Entertainment Technology III

Techniques, theories, and terminology of technical theatre. Focus on application of advanced stagecraft through safety, woodworking, metalworking, budgeting, project management, and shop management.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Pre-Requisite(s): (FA 2701 or THEA 2310) and (FA 2706 or THEA 2110)

THEA 3130 - Costume Technology III

Building on basic sewing skills and costume technology, students will explore fabrics and more advanced construction techniques: patterning methods such as flat patterning, draping, gridding, pattern alterations for fit and using slopers, construction of historical costumes such as corsets.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years
Pre-Requisite(s): THEA 2130

THEA 3201 - Theatre History

Study of the Cultural History of Theatre from is likely beginnings through the contemporary period, including traditions of both eastern and western theatre.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand

THEA 3230 - Costume History

A study of costume fashion, emphasis on the western world, from antiquity through the 20th Century. Including: basic characteristics of each period, environmental & cultural influences, specific costume terminology. Comparative analysis of historic costume choices found in film & theatre.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years

THEA 3320 - Lighting Design

Fundamentals of designing lighting for theatre, architecture and entertainment through various explorations and projects. Focus on professional design development and presentation techniques; theatrical drafting conventions, light sketches, plots. Also, designer/director relationships, script analysis, research, design concepts/history.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): THEA 1120 and UN 1015

THEA 3330 - Costume Design

Fundamentals of designing costumes through various explorations and projects. Focus on professional design development and presentation techniques: costume renderings, patterning, color/fabric analysis. Also script/character analyses, research, design concepts.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman

THEA 3340 - Scenic Design

An introduction to scenic design for theatre and collaborative design in entertainment. This project-based class develops technical and conceptual skills: collaborative relationships, design development, story boards, rendering paint elevations, model making, hand drafting.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): THEA 1110

THEA 3400 - Acting II

Through focused scene study with partners, and solo exercises students will build on the fundamental skills gained in Acting I. Practitioners like Boleslavsky, Meisner, Stanislavski and Hagen are discussed and applied to the student's training.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman
Pre-Requisite(s): THEA 1400

THEA 3650 - Portfolio Development

Techniques for building a professional design and technical portfolio for the theatre and entertainment industry. The final result of the course will be a portfolio of all work to date.
Credits: 1.0
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

THEA 3660 - Stage Management

Procedures and skills for effective stage management of theatrical productions, including coordination of performers and technicians during rehearsal and performance periods. Instruction in stage manager's notation used for blocking, scene shifts, and cues for lighting, sound, special effects, and performers.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Restrictions: May not be enrolled in one of the following Class(es): Freshman

THEA 3661 - Design & Management Practicum

Open to students who take significant responsibility for a Visual and Performing Arts entertainment production, such as: stage manager, assistant technical director, master electrician, or wardrobe head.
Credits: 2.0; May be repeated
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required
Pre-Requisite(s): FA 2661 or THEA 2610

THEA 3663 - Career Development: Professional Presentation

Provides students the opportunity to present at professional events which contribute to the development of their careers. Students will prepare and present design, technical, or performance projects, papers, and/or posters to be viewed and critiqued by professionals at such events as KCACTF, AES, USITT, and URTA.
Credits: 1.0; Repeatable to a Max of 4
Lec-Rec-Lab: (0-0-1)
Semesters Offered: Fall, Spring
Pre-Requisite(s): FA 3700 or FA 3730 or FA 3750 or FA 3760 or FA 3650 or FA 2640 or FA 2730 or FA 2705 or THEA 3340(C) or SND 3330(C) or THEA 3320(C) or THEA 3330(C) or THEA 3660(C) or THEA 2330(C) or THEA 2130(C) or THEA 2111(C)

THEA 3850 - Special Topics: Theatre

Tutorial, seminar, or class study of a topic of special interest and importance in visual and performing arts.
Credits: variable to 3.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

THEA 3860 - Special Topics Workshop: Theatre

Special workshop projects in the visual and performing arts.
Credits: variable to 6.0; Repeatable to a Max of 6
Semesters Offered: On Demand
Restrictions: Permission of instructor required

THEA 4110 - Entertainment Mechanics and Rigging

Practical application and theory of entertainment mechanics and rigging. Emphasis will be placed on theatrical equipment such as fly systems, turntables, and scenery lifts. Course will also explore automation through pneumatics, hydraulics, and motor control.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, in even years
Pre-Requisite(s): FA 1701 or THEA 1110

THEA 4190 - Directing for Theatre

In-depth study of process of directing stage productions. Students learn/practice the director's process of analyzing scripts, developing vision/concept for production, casting, staging and coaching. Students will also learn methodologies for leading a design team in creating a cohesive production.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Restrictions: Permission of instructor required

THEA 4400 - Acting: Shakespeare

Provides knowledge and experience reading, analyzing and performing period works, with a special focus on Shakespearean verse and prose.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: On Demand
Pre-Requisite(s): (FA 2820 or THEA 1000) and (FA 2600 or THEA 1400) and THEA 2400 and (FA 3600 or THEA 3400(C))

THEA 4402 - Musical Theatre Performance

Provides specialized experience in performance styles of the musical theatre through scene-study and process from sheet music to the stage.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in odd years
Pre-Requisite(s): THEA 1400

THEA 4660 - Production Management for the Entertainment Industry

Focus on techniques to coordinate production and artistic operations for the theatre and entertainment industries and venues. Emphasis on effective event management processes including: safety, budgeting, scheduling, personnel, rehearsals, performance, communication, facilities.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Spring, in even years
Restrictions: May not be enrolled in one of the following Class(es): Freshman

THEA 4800 - Independent Study: Theatre

Independent research directed by Visual and Performing Arts faculty. Projects focus on one or more of the visual and performing genres; theatre, music, visual art. Requires a written proposal setting out goals, plans for final project, and the resources required to complete the project.
Credits: variable to 6.0; May be repeated
Semesters Offered: Fall, Spring
Restrictions: Permission of instructor required

THEA 4900 - Final Project: Entertainment Technology

Capstone course extending the student's knowledge and skill in a chosen fine arts discipline through independent research or other focused creative activity. A detailed proposal of the student's final project must be approved in writing by a Visual and Performing Arts faculty advisor before the student enrolls.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

University Wide

UN 0100 - International Student Success Seminar

This course provides first-time international graduate students with strategies for success including acculturation information and resources to help them adjust to the Michigan Tech community. The completion of this course is mandatory for all new international graduate students.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (1-0-0)
Semesters Offered: Fall, Spring
Restrictions: Must be enrolled in one of the following Level(s): Graduate

UN 1000 - Frameworks for Success for ExSEL

Course that explores ways to become a more effective student. The course focuses on metacognition and individual learning styles, the skills and habits that support academic success, and utilizing campus resources.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

UN 1011 - Strategies for Success

Seminar course that provides a framework to assess the strategies a student is currently using to achieve academic, professional, and personal success. The course is designed to look at ways to improve upon a student's strategies for success or adopt new ones. This course is required for all first-year or transfer (with less than 30 credits) students who are on academic probation for the first time after fall or spring of their first year. This course is also available with permission from the Dean of Students, to any student who feels they would benefit from additional strategies for success.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Spring, Summer

UN 1013 - Michigan Tech Seminar

Critical reflection practice, pathway planning, and development of success habits to promote personal well-being and academic success.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

UN 1015 - Composition

Provides direct instruction in composition. Students examine and interpret communication practices and apply what they learn to their own written, aural, and visual compositions. Class projects ask students to communicate in a variety of modes and to attend to audience, purpose, and context.
Credits: 3.0
Lec-Rec-Lab: (0-3-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Freshman, Sophomore

UN 1017 - Roots of Sustainability

Designed for first year residents of the TreeHouse Sustainability Learning Community, this course provides students with a foundational understanding of sustainability topics and the resources to explore their interests further within their major and personal involvement. The course design encourages discussion and active learning.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall
Restrictions: Permission of instructor required

UN 1020 - STEM Success 101

This course is designed to aid students in their transition from high school into a STEM degree by introducing metacognitive reflection skills, organizational strategies, and academic learning resources. Content will focus on transitioning from dependent to independent learning, time prioritization, major and career planning, career navigation, and mental health.
Credits: 1.0
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall, Summer
Restrictions: Permission of instructor required

UN 1025 - Global Issues

Study of contemporary global issues, their origins, impacts, and solutions through the thematic and comparative exploration of worldview and culture, population, globalization, development, politics and global governance, environment, and sustainability. Emphasis on global literacy and information literacy.
Credits: 3.0
Lec-Rec-Lab: (3-0-0)
Semesters Offered: Fall, Spring, Summer
Restrictions: Must be enrolled in one of the following Class(es): Freshman

UN 2013 - Michigan Tech Transfer Seminar

Critical reflection practice, pathway planning, and success habits tailored to transfer students with prior college experience.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-0-2)
Semesters Offered: Fall

UN 2600 - Fundamentals of Nanoscale Science and Engineering

Team-taught introduction to the fundamentals of nanotechnology, emphasizing the interdisciplinary nature of this field. Modern instrumentation, key scientific foundations, and current and potential applications will be discussed. Real and potential societal implications of nanotechnology will be explored.
Credits: 2.0
Lec-Rec-Lab: (1-1-0)
Semesters Offered: Spring, in even years

UN 3002 - Undergraduate Cooperative Education I

Credits may count as free or technical electives based on academic department. Requires advisor approval, good conduct and academic standing, registration with Career Services, and an official offer letter from the employer.
Credits: variable to 2.0
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Level(s): Graduate

UN 3003 - Undergraduate Cooperative Education II

Credits may count as free or technical electives based on academic department. Requires advisor approval, good conduct and academic standing, registration with Career Services, and an official offer letter from the employer.
Credits: variable to 2.0
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): UN 3002

UN 3004 - Undergraduate Cooperative Education III

Credits may count as free and technical electives based on academic department. Requires advisor approval, good conduct and academic standing, registration with Career Services, and an official offer letter from the employer.
Credits: variable to 2.0; May be repeated
Semesters Offered: Fall, Spring, Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Level(s): Graduate
Pre-Requisite(s): UN 3003

UN 3005 - Undergraduate Short Cooperative Education

Credits may count as free or technical electives based on academic department. Requires advisor approval, good conduct and academic standing, registration with Career Services, and an official offer letter from the employer.
Credits: variable to 2.0; May be repeated
Semesters Offered: Summer
Restrictions: Permission of department required; May not be enrolled in one of the following Level(s): Graduate

UN 3013 - Interdisciplinary Experience

Study of interdisciplinary and experiential special topics as specified by section title.
Credits: variable to 6.0; May be repeated
Semesters Offered: On Demand

UN 3023 - Advanced Portfolio for Essential Ed

Students will reflect on their academic journey so far and learn techniques to prepare a showcase portfolio. Course will support Essential Ed minors.
Credits: 1.0; Graded Pass/Fail Only
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall, Spring
Restrictions: May not be enrolled in one of the following Class(es): Freshman

UN 3990 - Special Topics - Interdisciplinary

Study of interdisciplinary special topics as specified by section title.
Credits: variable to 6.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required

UN 4000 - Seminar Series in Earth, Planetary, and Space Sciences

A seminar series that covers topical issues in remote sensing, ecosystem research, global change, and space sciences.
Credits: 1.0; Repeatable to a Max of 2
Lec-Rec-Lab: (0-1-0)
Semesters Offered: Fall
Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

UN 4990 - Special Topics - Interdisciplinary

Study of interdisciplinary special topics as specified by section title.
Credits: variable to 6.0; May be repeated
Semesters Offered: On Demand
Restrictions: Permission of instructor required