SCIENCE & MATH

Programs

- Engineering - Associate of Science in Engineering (https://catalog.nmc.edu/archives/2021-2022/programs-az/science-math/engineering-ase/)
- Plant Science - Fruit and Vegetable Crop Management, Associate in Applied Science Degree (https://catalog.nmc.edu/archives/2021-2022/programs-az/science-math/plant-science-fruit-vegetable-crop-management/)
- Plant Science - Landscape Management, Associate in Applied Science Degree (https://catalog.nmc.edu/archives/2021-2022/programs-az/science-math/plant-science-landscape-management-associate/)
- Plant Science - Viticulture, Associate in Applied Science Degree (https://catalog.nmc.edu/archives/2021-2022/programs-az/science-math/plant-science-viticulture/)

Courses

Astronomy

AST 100 - Observational Astronomy
Credit Hours: 2, **Contact Hours: 2**
Division: Science Math
This course is an introduction to astronomy. The goal of this course is to acquaint the student with the constellations, solar system objects and their motions, the celestial sphere concept and co-ordinate system. Stars, star clusters, nebulae and galaxies are also studied. Students will use naked-eye observations as well as telescopes, spectrograph, photometer and CCD camera to observe and report findings. Each session includes training in the operation of astronomical equipment. Group 2 course.
Recommended Prerequisite(s): ENG 111, MTH 23

AST 109 - Planetary Astronomy
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
Characteristics and properties of the solar system and its components are presented to students in the context of the history of discovery. This information is integrated with student observational data to develop a mathematical model in the laboratory. The model is developed by incorporating equations used to compute characteristics and properties of solar system components. The model is utilized by students to encourage understanding of why the solar system has evolved to its current state by evaluating the effects of changes in values of fundamental measured properties and characteristics. Group 1 lab course. Critical Thinking - Direct.
Required Prerequisite(s): MTH 111; ENG 11/111 or ENG 111 may be taken concurrently

Corequisites: AST 109L

AST 109L - Planetary Astronomy Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See AST 109 for course description.
Corequisites: AST 109

AST 119 - Astronomy
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
History of discovery of the nature of the cosmos and its contents is the format utilized to develop understanding of the nature of stars and the universe, and the physical principles determining this nature. These principles underlie our proficiency for prediction of the nature of the universe and our ability to make observations of our universe. The principles are analyzed by means of a student developed mathematical model incorporating the quantitative relationships derived by physicists and astronomers. Observations provide students with the sky knowledge and data necessary for prediction of stellar characteristics. Group 1 lab course. Critical Thinking - Direct.
Required Prerequisite(s): MTH 111; ENG 11/111 or ENG 111 may be taken concurrently

Corequisites: AST 119L

AST 119L - Astronomy Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See AST 119 for course description.
Corequisites: AST 119

Biology

How to select a first course in Biology: If you are in a transfer program requiring a full year of introductory biology such as pre-med, pre-dental, pre-vet, agriculture, wildlife and fisheries, or environmental programs, you should choose:

- BIO 115 Cell,Plant & Ecosystem Biology
- BIO 116 Genetic, Evolution, Animal Bio

If you need a one semester laboratory science course to fulfill a basic education requirement, you should choose:

- BIO 110 Essential Biology

All of the above include a common core that is basic to the understanding of any branch of biology. The core topics include cell structure and function, genetics, the chemical and physical principles governing life processes, and evolution. Any 100-level Biology course may serve as a prerequisite for 200-level Biology courses.

It has been the experience of the Biology Department that students with placement scores below MTH 23 Beginning Algebra and ENG 111 English Composition levels have difficulty successfully completing introductory-level biology courses. If your placement scores are below these levels, the Biology Department recommends that you complete ENG 99 Intro to College Writing, ENG 108 Critical Reading Strategies or ENG 11 English/Writing Methods/ENG 111 English Composition and MTH 08 before enrolling in any biology course. If your placement scores are below these levels and you decide to enroll in a Biology course, allow yourself additional time for study and preparation. If you are unsure of your ability, consult your advisor, or a biology instructor.

BIO 106 - Human Biology
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
A survey of human anatomy and physiology with a primary focus on health and disease. Topics to be discussed will include the cell structure, simple chemistry of biology, homeostasis, the organ systems, genetics, evolution, nutrition, exercise physiology, cancer, heart disease, immunology, AIDS, and other topics of current interest. This course does not meet the requirements for the Nursing program. Consult an advisor before enrolling. Group 1 lab course. Critical Thinking - Direct.
Recommended Prerequisite(s): ENG 111, MTH 23

Corequisites: BIO 106L

BIO 106L - Human Biology Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See BIO 106 for course description.
Corequisites: BIO 106

BIO 108 - Plant Biology
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
In this class, we will examine some of the major ideas biologists use to study the living world. These will include the scientific method, biology of cells, and genetics. The emphasis in this course will be on: plant anatomy, the life cycle of plants, growth and its regulation, metabolism, and reproduction. Field and laboratory exercises, as well as experiments in the greenhouse, will allow the student to observe these principles, and practice the skills required to cultivate and propagate plants. Group 1 lab course. Quantitative Reasoning.
Recommended Prerequisite(s): ENG 111, MTH 23

Corequisites: BIO 108L

BIO 108L - Plant Biology Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See BIO 108 for course description.
Corequisites: BIO 108

BIO 110 - Essential Biology
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
Essential Biology is geared toward the non-major. The course will cover broad areas of biology, engage the student in how biology relates to their own life, and how science and society interact. Core concepts covered include: Evolution, Structure and Function, Information Flow, Exchange and Storage, Pathways and Transformations of Energy and Matter, and Living Systems. Group 1 lab course. Critical Thinking - Direct.
Recommended Prerequisite(s): ENG 111, MTH 23

Corequisites: BIO 110L

BIO 110L - Essential Biology Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See BIO 110 for course description.
Corequisites: BIO 110

BIO 115 - Cell,Plant & Ecosystem Biology
Credit Hours: 4, **Contact Hours: 6**
Division: Science Math
An introduction to the fundamental concepts of biology, including an investigation of the major kingdoms of life, classification, ecology, botany, cellular anatomy and biochemistry, DNA structure and function, genetic engineering, cloning and stem cell technologies. Laboratory includes field work and investigative exercises which illustrate lecture topics. Group 1 lab course. Critical Thinking - Direct.
Recommended Prerequisite(s): ENG 111, MTH 111

Corequisites: BIO 115L

BIO 115L - Cell, Plant, Ecosystem Bio Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See BIO 115 for course description.
Corequisites: BIO 115

BIO 116 - Genetic, Evolution, Animal Bio
Credit Hours: 4, **Contact Hours: 6**
Division: Science Math
The lecture and laboratory portions of this course focus on cell division, classical genetics, evolution and phylogeny as well as the classification and Phyla-level natural history of invertebrate and vertebrate animals. Also, the course covers the anatomy and physiology of organisms found in the Animal Kingdom. The treatment of the topics in this course necessarily assumes a degree of familiarity with the basic biological concepts covered in BIO 115. Students who have not completed BIO 115 should expect to spend extra time reviewing these concepts throughout the course. Group 1 lab course. Critical Thinking - Direct.
Recommended Prerequisite(s): BIO 115, ENG 111, MTH 111

Corequisites: BIO 116L

BIO 116L - Genetic, Evolu, Animal Bio Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See BIO 116 for course description.
Corequisites: BIO 116

BIO 120 - The Science of Stress
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
Students will explore current research on stress and its impacts on body systems. Discussion of scientific research and application of coping strategies will provide an experiential understanding of stress on learning, anxiety and depression as well as tools for resilience. This class meets in the anatomy and physiology lab to directly understand regions of the brain and body that are affected by stress. We will also meet on occasion in the SIM lab in order to measure biological parameters of stress as the class progresses. Critical Thinking - Direct.

BIO 208 - Microbiology
Credit Hours: 4, **Contact Hours: 6**
Division: Science Math
This course reviews the two types of cells (prokaryotic and eukaryotic). Microbial anatomy, physiology, and diversity are introduced. Microbiological disease pathology and the role of microbes in food production are also discussed. This class includes an oral presentation on a disease caused by microbes, a diversity smorgasbord, a group project on a group of microbes, and a write-up on how microbes are used in food. Laboratory work culminates with the identification of an unknown bacterial solution. Group 1 lab course. Quantitative Reasoning. Quantitative Reasoning.
Required Prerequisite(s): Completion of any 100-level BIO course

Recommended Prerequisite(s): ENG 111, MTH 111

Corequisites: BIO 208L

BIO 208L - Microbiology Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See BIO 208 for course description.
Corequisites: BIO 208

BIO 215 - Genetics
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
A comprehensive treatment of classical genetics will be covered in addition to an in-depth study of molecular genetics, research techniques and applications of recombinant DNA technology. A major emphasis will be on the current results of genetic research as it applies to the molecular mechanisms of inheritance, and other topics such as gene therapy, cloning stem cell research and genetically modified organisms. Population genetics will also be covered. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): Completion of any 100-level BIO course

Recommended Prerequisite(s): ENG 111, MTH 111

BIO 220 - Nutrition in Human Health
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
This course is an exploration of the fundamentals of nutrition: energy nutrients, vitamins and minerals. Function and sources of each is presented, as well as the role each plays in maintaining health. Students complete their own Food Intake Record and use this information throughout the semester so as to better understand human nutrition. In addition, study is made of the role nutrition along with other lifestyles plays in the prevention and protection from disease. Discussion also includes the relationship between nutrition and fitness. Group 2 course. Critical Thinking - Direct.
Recommended Prerequisite(s): ENG 111, MTH 111, and completion of any 100-level BIO course

BIO 227 - Human Anatomy & Physiology I
Credit Hours: 4, **Contact Hours: 6**
Division: Science Math
This course will include an introduction to cells, histology, biochemistry, and homeostasis. In addition, the following systems will be discussed: integumentary, skeletal, muscle, nervous, and special senses. Lecture will be accompanied by lab work and applications, which will stress the anatomy, histology and function of these organ systems. Group 1 lab course. It is highly recommended that students have college level reading skills. Students enrolling in BIO 227 who have not completed these requirements should plan on additional study time. Quantitative Reasoning.
Required Prerequisite(s): MTH 111 and ENG 11/111 or ENG 111 both may be taken concurrently

Recommended Prerequisite(s): CHM 101, HAH 101, and completion of any 100-level Biology course

Corequisites: BIO 227L

BIO 227L - Human Anatomy & Phys I Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See BIO 227 for course description.
Corequisites: BIO 227

BIO 228 - Human Anatomy & Physiology II
Credit Hours: 4, **Contact Hours: 6**
Division: Science Math
This is the second part of a two-semester course. The second semester will continue major systems in the body including: the endocrine system, cardiovascular system, lymphatic system, respiratory system, digestive system, metabolism, urinary system, fluid balance, reproduction and inheritance. Lecture will be accompanied by lab work, which will stress the anatomy and histology of these organ systems. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): BIO 227, BIO 227L, MTH 111; ENG 11/111 or ENG 111

Corequisites: BIO 228L

BIO 228L - Human Anatomy & Phys II Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See BIO 228 course description.
Corequisites: BIO 228

BIO 240 - Normal and Clinical Nutrition
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
Nutrition is considered from a strong biological point of view. Discussions will include a brief overview of principles of normal nutrition and then will proceed to how these principles apply to cause and treatment of specific disease states and the nutrition care process required. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): MTH 23

Recommended Prerequisite(s): BIO 227, ENG 111, MTH 111

BIO 255 - Pathophysiology
Credit Hours: 4, **Contact Hours: 4**
Division: Science Math
This course covers the etiology, progression, and treatment of disease in the human body. Cellular and tissue structure and function are addressed along with the role of the immune system in body defenses. Disorders and diseases for each body system are covered, including investigation of clinical case studies of pathophysiology. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): BIO 228, BIO 228L with grade of 2.0 or better

Recommended Prerequisite(s): BIO 208, ENG 111, HNR 107

BIO 268 - Biochemistry
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
This course is a study of the basic fundamentals of the chemical composition of living matter with application of concepts to normal and abnormal human function. Structure and function of proteins, lipids, carbohydrates and nucleic acids will be covered as well as their metabolic interrelationships. The course also covers the most current biochemical techniques, and an investigation of molecular genetics and published findings in the field of biochemistry. Group 1 course. Critical Thinking - Direct.
Required Prerequisite(s): CHM 101 or CHM 150

Recommended Prerequisite(s): BIO 227, BIO 227L, ENG 111, MTH 23

BIO 293 - Biology Study Abroad
Credit Hours: 1, **Contact Hours: 1**
Division: Science Math
In this class, students are provided the opportunity to travel to a specified destination affiliated with the corresponding biology non-trip course. This course will serve to integrate the student learning experience and provide a sense of cultural perspective, diversity and regional awareness. The course is an opportunity for students to explore other areas around the world while applying discipline-specific course content. For a more specific course description, please review the course description of the associated non-trip course. Group 2 course.
Required Prerequisite(s): BIO 110 and BIO 110L, or BIO 115 and BIO 115L, or BIO 116 and BIO 116L

Chemistry

CHM 101 - Introductory Chemistry
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
A one-semester chemistry course for the non-science major exploring the language, concepts and methods of chemistry. Topics include atomic theory, chemical periodicity, chemical bonding, stoichiometry, gases, nuclear energy, equilibrium, and acid/base chemistry. The laboratory will include descriptive and analytical experiments, focusing on measurement, physical and chemical properties of materials, acids and bases, laboratory procedures and calculations. Science, engineering, and premedical students must select CHM 150 and 151 to meet chemistry requirements. Consult with an advisor before enrolling. Group 1 lab course. Students enrolling in CHM 101 who have not completed these requirements should plan on additional study time. Quantitative Reasoning.
Required Prerequisite(s): MTH 111 with a grade of 2.0 or better

Recommended Prerequisite(s): ENG 111; the ability to work algebraic problems involving unknown variables, fractions, percents and proportions

Corequisites: CHM 101L

CHM 101L - Introductory Chemistry Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See CHM 101 for course description.
Corequisites: CHM 101

CHM 150 - General Chemistry I
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
First semester of a two-semester course covering matter and chemical measurement, basic laws, chemical symbols and formulas, stoichiometry and chemical calculations, gases and the gas laws, thermochemistry, atomic structure, electron configurations and the periodic table, elements, chemical bonding and molecular structure, intermolecular forces, liquids and solids. The laboratory includes descriptive and quantitative experiments illustrating the above topics. The recitation includes problem solving, quizzes, and laboratory preparation to accompany lectures. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): MTH 111 with a grade of 2.0 or better

Recommended Prerequisite(s): MTH 121; ENG 111 with a grade of 2.0 or better

Corequisites: CHM 150L, CHM 150R

CHM 150L - General Chemistry I Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See CHM 150 for course description.
Corequisites: CHM 150, CHM 150R

CHM 150R - General Chemistry I, Recitatn
Credit Hours: 1, **Contact Hours: 2**
Division: Science Math
Problem solving quizzes and laboratory preparation to accompany lectures. Group 1 course.
Required Prerequisite(s): MTH 111 with a grade of 2.0 or better

Recommended Prerequisite(s): ENG 111 with a grade of 2.0 or better, MTH 121

Corequisites: CHM 150, CHM 150L

CHM 151 - General Chemistry II
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
A second semester course covering chemical reactions in aqueous solution including acid-base and oxidation and reduction reactions, properties of solutions, chemical kinetics, gaseous equilibria, acids and bases, acid-base equilibria, pH, common ion effect, buffer systems, solubility product constant, thermodynamics, enthalpy, entropy, and free energy, electrochemistry, and nuclear chemistry. The laboratory will cover the above topics using quantitative and qualitative procedures. The recitation involves problem solving, quizzes and laboratory preparation to accompany lectures. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): CHM 150, CHM 150L, CHM 150R; MTH 111, all with a grade of 2.0 or better

Recommended Prerequisite(s): ENG 111 with a grade of 2.0 or better

Corequisites: CHM 151L, CHM 151R

CHM 151L - General Chemistry II Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See CHM 151 for course description.
Corequisites: CHM 151, CHM 151R

CHM 151R - General Chemistry II Recitatn
Credit Hours: 1, **Contact Hours: 2**
Division: Science Math
Problem solving, quizzes and laboratory preparation to accompany lectures. Group 1 course.
Required Prerequisite(s): CHM 150, CHM 150L, CHM 150R; MTH 111, all with a grade of 2.0 or better

Recommended Prerequisite(s): ENG 111 with a grade of 2.0 or better

Corequisites: CHM 151, CHM 151L

CHM 201 - Intro to Organic Chemistry
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
An introduction to organic chemistry. Topics include the classes of organic compounds, reactions, synthesis, and mechanisms. Includes laboratory. NOTE: This course is a one semester course and is not appropriate for all majors. Please check with an advisor prior to registration. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): CHM 101 or CHM 150 and MTH 111, all with a grade of 2.0 or better

Recommended Prerequisite(s): ENG 111

Corequisites: CHM 201L

CHM 201L - Intro to Organic Chemistry Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See CHM 201 for course description. Quantitative Reasoning.
Corequisites: CHM 201

CHM 250 - Organic Chemistry I
Credit Hours: 5, **Contact Hours: 9**
Division: Science Math
The first semester of a two-semester course covering the chemistry of carbon compounds. Designed to meet the requirements for majors in chemistry, chemical engineering, biological science, pre-medicine, etc. Topics include nomenclature, structure, aliphatic compounds, free-radical, nucleophilic substitution and elimination reactions, electrophilic addition reaction and mechanisms, alkyl halides, alkenes, alkynes and alcohols. The laboratory portion will cover fundamental organic laboratory techniques of synthesis, separation and analysis. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): CHM 151, CHM 151L, CHM 151R, MTH 111, all with a grade of 2.0 or better

Recommended Prerequisite(s): ENG 111 with a grade of 2.0 or better

Corequisites: CHM 250L

CHM 250L - Organic Chemistry I Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See CHM 250 for course description.
Corequisites: CHM 250

CHM 251 - Organic Chemistry II
Credit Hours: 5, **Contact Hours: 9**
Division: Science Math
A follow-up to CHM 250. Topics include alcohols, aromatics, ethers and epoxides, arenes, carbonyls, carboxylic and sulfonic acids and their derivatives, amines, phenols, aryl halides, carbohydrates, amino acids, biochemical processes, and others together with appropriate mechanistic theories and structural concepts. Instrumental techniques discussed include infrared spectroscopy (IR), nuclear magnetic resonance (NMR), mass spectrometry (MS), and ultraviolet (UV) spectroscopy. The lab exercises will continue the development of organic chemistry laboratory technique on both semi-microscale and microscale. In addition, analytical techniques using infrared spectroscopy and gas chromatography will be developed. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): CHM 250, CHM 250L, MTH 111, all with a grade of 2.0 or better

Recommended Prerequisite(s): ENG 111 with a grade of 2.0 or better

Corequisites: CHM 251L

CHM 251L - Organic Chemistry II Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See CHM 251 for course description.
Corequisites: CHM 251

Engineering

EGR 101 - Introduction To Engineering
Credit Hours: 1, **Contact Hours: 1**
Division: Science Math
This course is a general overview of the field of engineering. Emphasis is on curricula, categories of engineering and the role of the engineer. Required for all first-year students in the engineering program. Group 2 course. Critical Thinking - Direct.
Recommended Prerequisite(s): ENG 111

EGR 113 - Engineering Graphics I
Credit Hours: 3, **Contact Hours: 4**
Division: Science Math
This course introduces traditional and contemporary methods of graphical communication in the context of engineering design, including sketching, orthographic projection, dimensioning, and tolerancing. Students also utilize modern parametric design software to generate 3-D models and 2-D drawings to benchmark and refine designs, including the use of finite element analysis and 3-D printing. Group 2 course. Critical Thinking - Direct.
Recommended Prerequisite(s): ENG 111, MTH 122

EGR 131 - Elementary Surveying
Credit Hours: 5, **Contact Hours: 5**
Division: Science Math
This course is designed to satisfy the elementary surveying requirement for a student entering engineering. In this course students will learn the theory involved in plane and geometric surveying including both linear and angular measurement, differential leveling, trigonometric leveling, traverse computations, electronic distant measurements, GPS mapping, topographical mapping and the design of horizontal and vertical curves as related to construction surveys. Students are expected to perform lab experiments in which they demonstrate their knowledge of the concepts learned in lecture, incorporating the basic skill learned in lecture to field settings. Care, adjustment, and use of basic surveying instruments: leveling, taping, horizontal angle measurements, traverse surveys, use of EDM's, GPS usage, topographic mapping, and layout of horizontal curves. Computer software will be used throughout the semester. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): MTH 122

Recommended Prerequisite(s): ENG 111

Corequisites: EGR 131L

EGR 131L - Elementary Surveying Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See EGR 131 for course description.
Corequisites: EGR 131

EGR 201 - Statics
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
This course addresses force systems in two and three dimensions and 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 and first semester calculus is used throughout the course. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): MTH 141

Recommended Prerequisite(s): ENG 111, MTH 142

EGR 202 - Mechanics of Materials
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
This course introduces the engineering behavior of real 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. Vector algebra and differential calculus are used throughout this course. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): EGR 201

Recommended Prerequisite(s): ENG 111, MTH 142

EGR 203 - Dynamics
Credit Hours: 4, **Contact Hours: 4**
Division: Science Math
This course introduces the principles of engineering dynamics, including kinematics and kinetics of particles, rigid bodies in translation, rotation, and plane motion. Principles of work and energy, impulse and momentum, and introductory vibrations will be covered. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): EGR 201

Recommended Prerequisite(s): ENG 111, MTH 241

EGR 211 - Electrical Circuits I
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
This course will cover basic electrical concepts, resistive circuits, nodal and loop analysis techniques, superposition, Thevenin and Norton equivalents, maximum power transfer, capacitance and inductance, AC steady-state analysis, steady-state power analysis. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): MTH 142, may be taken concurrently

Recommended Prerequisite(s): ENG 111

EGR 220 - Engineering Practice I
Credit Hours: 2, **Contact Hours: 4**
Division: Science Math
Students develop the laboratory and computer skills necessary for success in engineering. Topics include benchmarking, prototyping, data acquisition devices and methods, data post processing and interpretation using engineering software, and use of finite element analysis methods. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): EGR 101, EGR 113, EGR 201, ENG 111

EGR 221 - Material Science
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
Introduction to the structure, processing, properties, and performance of engineering materials, including metals, polymers, glasses, ceramics, and composites. Presents case studies covering selection of materials, component design, and analysis of component failures. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): MTH 141, ENG 111; CHM 150 may be taken concurrently

EGR 232 - Introductory Thermodynamics
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
This course introduces concepts of energy, energy conversion, and mechanisms of heat and work transfer in processes and in cycles. It also covers the first and the second laws of thermodynamics. Group 2 course. Critical Thinking - Direct.
Required Prerequisite(s): MTH 141, PHY 221, PHY 221L, PHY 221R

Environmental Sciences

ENV 103 - Earth Science
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
Designed for the student who does not intend to major in a physical science. Subject matter deals with features of the planet Earth, astronomy, and weather. The laboratory portion includes a practical study of rocks and minerals as well as a study of topographic, geologic and weather maps. Field trips investigate landforms in the Grand Traverse area. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): MTH 08 or equivalent

Recommended Prerequisite(s): ENG 111

Corequisites: ENV 103L

ENV 103L - Earth Science Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See ENV 103 for course description.
Corequisites: ENV 103

ENV 104 - Life of the Past
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
This course introduces students to the record of life on Earth. The roles of global change, origins, evolution, and extinction in life history are examined. Great Lakes and North American fossil records with Prepaleozoic microorganisms and Paleozoic invertebrates and vertebrates are highlighted. Appearance, evolution, and disappearance of dinosaurs during the Mesozoic Era, human evolution, and the recent demise of the giant Ice Age mammals are analyzed in depth. Laboratory and class activities are included. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): MTH 08 or equivalent

Recommended Prerequisite(s): ENG 111

Corequisites: ENV 104L

ENV 104L - Life of the Past Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See ENV 104 for course description.
Corequisites: ENV 104

ENV 111 - Physical Geology
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
This course explores processes which transform planet Earth. Landforms, minerals, rocks, and geologic structures are examined in classroom, laboratory, and field studies, which focus on these geologic processes, and on the techniques of geology. Lab studies apply the methodology and techniques of geology by introduction of map reading, field and map study, study of surficial processes, and study of minerals and rocks. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): MTH 23 or equivalent

Recommended Prerequisite(s): ENG 111

Corequisites: ENV 111L

ENV 111L - Physical Geology Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See ENV 111 for course description.
Corequisites: ENV 111

ENV 112 - Historical Geology
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
Rocks and fossils of North America, the Great Lakes and the Grand Traverse region which reveal the physical, chemical, and biological evolution of the planet Earth are explored in classroom, laboratory, and field studies (including a required 4-day field excursion to Elliot Lake, Ontario). Group 1 lab course. Quantitative Reasoning.
Recommended Prerequisite(s): ENV 103 or ENV 111 or GEO 105; ENG 111, MTH 111

Corequisites: ENV 112L

ENV 112L - Historical Geology Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See ENV 112 for course description.
Corequisites: ENV 112

ENV 117 - Meteorology & Climatology
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
Designed to acquaint the student with the science and art of weather analysis, this course includes studies of the basic properties of gases, organization and composition of the atmosphere, basic energy flow, and general weather phenomena that result. Global climates are also investigated. The laboratory portion presents the function and effect of selected physical processes, and includes the use of weather instruments and weather maps. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): MTH 23

Recommended Prerequisite(s): ENG 111

Corequisites: ENV 117L

ENV 117L - Meteorology & Climatology Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See ENV 117 for course description. Co-req = ENV 117.
Corequisites: ENV 117

ENV 131 - Oceanography
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
This course explores the origins, structure, and evolution of ocean basins and their role in global climate dynamics. It shall include an investigation of the physical properties that govern waves, currents, tides, air-sea interactions as well as the physical and chemical properties of seawater. It also explores plant and animal life within the oceans including impacts of human activities on the marine environment. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): MTH 23

Recommended Prerequisite(s): ENG 111

Corequisites: ENV 131L

ENV 131L - Oceanography Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See ENV 131 for course description.
Corequisites: ENV 131

ENV 140 - Watershed Science
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
This course is designed for the learner who wishes to gain an in-depth understanding of watersheds. It will focus on the physical and biological systems that are responsible for the quality and characteristics of a watershed. Human interactions, stewardship, management and impacts on our local water resources will also be explored. The laboratory portion of the course will place emphasis on field investigations and the analysis of data and water samples collected. Basic scientific principles will be incorporated throughout the course. Group 1 lab course. Quantitative Reasoning.
Recommended Prerequisite(s): ENG 111, MTH 111

Corequisites: ENV 140L

ENV 140L - Watershed Science Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See ENV 140 for course description.
Corequisites: ENV 140

ENV 270A - Michigan Basin Geology
Credit Hours: 2, **Contact Hours: 3**
Division: Science Math
This course is a six-day field study of the Michigan Basin. The class focuses on the Paleozoic geologic history, fossil record, and economic geology of the lower Peninsula and eastern Upper Peninsula. The relationships of bedrock layers to recent surficial geologic processes and their associated landforms will be explored. Group 1 course. Communications - Direct.
Required Prerequisite(s): Completion of any science course with laboratory and instructor permission

Recommended Prerequisite(s): ENG 111, MTH 23

ENV 270B - Field Mapping Techniques
Credit Hours: 2, **Contact Hours: 3**
Division: Science Math
This course is a one-week field course. It will focus on the fundamentals of map interpretation and generation. Students will gain a basic understanding of the principles of cartography and field mapping techniques employed by various disciplines in the acquisition of spatial data. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): MTH 23, instructor permission required

Recommended Prerequisite(s): ENG 111, completion of any Science course with laboratory

ENV 270C - Precambrian Geology of MI
Credit Hours: 2, **Contact Hours: 3**
Division: Science Math
This course is a six-day field study of the Precambrian geology of the western Upper Peninsula of Michigan. The class will focus on rock and mineral identification, economic geology, and the geologic history of Michigan's Upper Peninsula. The relationships of ancient bedrock layers to recent surficial geologic processes and their associated landforms will also be explored. Group 1 course. Communications - Direct.
Required Prerequisite(s): Completion of any science course with laboratory and instructor permission

Recommended Prerequisite(s): ENG 111, MTH 23

Mathematics

Students are REQUIRED to have and learn to use a TI-84 graphing calculator for ALL math classes.

MTH 23 - Beginning Algebra
Credit Hours: 4, **Contact Hours: 4**
Division: Science Math
This is a basic course in algebra covering the following topics: operations on integers, rational numbers, numbers in scientific notation, and polynomials; exponent rules; dimensional analysis; solving linear equations; applications of linear equations in geometry, mixture, percents, and motion; graphing and analysis of graphs, particularly lines, in the coordinate plane; factoring; solving quadratic equations by factoring, applications of quadratic equations in geometry, mixture, percents and motion. The course concludes with an introduction to simplifying multiplying and dividing rational expressions and solving proportions. Good math writing form is stressed.
Required Prerequisite(s): A grade of 2.0 or better in MTH 08 or appropriate placement

MTH 111 - Intermediate Algebra
Credit Hours: 4, **Contact Hours: 4**
Division: Science Math
Intermediate Algebra covers elementary set notation, a description of the Real number system, its major subsets, and an introduction to the Complex number system. Simplifying exponents, and algebraic expressions. Solving linear, quadratic, rational, and radical equations. Linear inequalities and systems of equations are also solved. The function concept is referenced throughout including the graphical, symbolic and numerical representations. Group 2 course.
Required Prerequisite(s): A grade of 2.0 or better in MTH 23 or appropriate placement

Recommended Prerequisite(s): Placement into ENG 111

MTH 120 - Mathematical Explorations
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
This course is designed to meet the MTA graduation requirements in math for students whose programs of study have no further math requirements. This course is designed to develop quantitative reasoning skills as applied to personal and social issues. Topics will convey to the student the beauty and utility of mathematics, and its applications to modern society. Core topics include logic, models of growth (linear & exponential), personal finance, basic statistics and probability. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): A grade of 2.0 or better in MTH 23 or appropriate placement

Recommended Prerequisite(s): High school algebra and geometry; Placement into ENG 111

MTH 121 - College Algebra
Credit Hours: 4, **Contact Hours: 4**
Division: Science Math
This course covers algebra topics including functions, mathematical models, solving equations algebraically and graphically, polynomial functions, logarithmic functions, exponential functions, inverse functions, and linear and non-linear systems of equations. Applications are integrated throughout. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): A grade of 2.0 or better in MTH 111 or higher (excluding MTH 120 and MTH 131) or appropriate placement

Recommended Prerequisite(s): Placement into ENG 111

MTH 122 - Trigonometry
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
This course covers the definitions and graphic representations of the trigonometric functions. Triangles, angle measure, equations, identities, and inverse functions are discussed in detail. Law of Sines, Law of Cosines, and equations of the conic sections will also be covered. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): A grade of 2.0 or better in MTH 121 or higher (excluding MTH 131) or appropriate placement

Recommended Prerequisite(s): Placement into ENG 111

MTH 131 - Intro to Prob & Stats
Credit Hours: 3, **Contact Hours: 3**
Division: Science Math
Descriptive statistics, experimental design, an introduction to probability concepts and inferential statistics are included in the course. Descriptive statistics includes graphs of both numerical and categorical data, measures of central tendency, and measures of variation. The normal density function, linear regression, and the binomial model are included. One and two sample problems involving confidence intervals and significance tests are studied for the sample mean and the sample proportion. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): A grade of 2.0 or better in MTH 111 or MTH 120 or higher or appropriate placement

Recommended Prerequisite(s): Placement into ENG 111

MTH 141 - Calculus I
Credit Hours: 5, **Contact Hours: 5**
Division: Science Math
This is the first course in a traditional calculus sequence, emphasizing the development of the mathematical thought process. The topics covered include limits (definitions and limit proofs), continuity, derivatives of algebraic and trigonometric functions, applications of the derivative, the indefinite and definite integral, the fundamental theorem of calculus, and applications of integration. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): A grade of 2.0 or better in MTH 122 or higher (excluding MTH 131) or appropriate placement

Recommended Prerequisite(s): Placement into ENG 111

MTH 142 - Calculus II
Credit Hours: 5, **Contact Hours: 5**
Division: Science Math
This course is a continuation of Calculus I. The topics include differentiation and integration involving exponential, logarithmic, and inverse trigonometric functions. There is an introduction of various integration methods. L'Hospital's Rule, improper integrals, parametric equations, polar coordinates, and infinite sequences and series are also investigated. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): A grade of 2.0 or better in MTH 141 or equivalent

Recommended Prerequisite(s): Placement into ENG 111

MTH 241 - Calculus III
Credit Hours: 5, **Contact Hours: 5**
Division: Science Math
The course covers multivariable calculus including three-dimensional analytical geometry, vector valued functions, partial differentiation, and multiple integration (with applications of each), and vector calculus. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): A grade of 2.0 or better in MTH 142 or equivalent

Recommended Prerequisite(s): Placement into ENG 111

MTH 251 - Differential Equations
Credit Hours: 4, **Contact Hours: 4**
Division: Science Math
This course introduces the concepts of differential equations. Topics include: solving first and second order differential equations, and systems of linear differential equations. Solutions are found using analytical, numerical, or graphical techniques relating to quantitative modeling. Laplace transforms and solving non-linear differential equations are introduced. Complex numbers and their usefulness in solving differential equations is identified. Linear algebra is introduced including the topics of; vector spaces, subspaces, spanning sets, linear dependence and independence, basis and dimensions, eigenvalues, eigenvectors, and linear transformations. Group 1 course. Quantitative Reasoning.
Required Prerequisite(s): A grade of 2.0 or better in MTH 142 or equivalent

Recommended Prerequisite(s): Placement into ENG 111

Physics

PHY 105 - Physics of the World Around Us
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
This course is an introduction to the fundamental principles developed to describe the physical universe. In particular, the subjects of mechanics, heat, electricity and magnetism, waves, and light are surveyed. The development of conceptual understanding and critical-thinking skills is emphasized. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): MTH 23

Recommended Prerequisite(s): ENG 111

Corequisites: PHY 105L

PHY 105L - Physics/World Around Us Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See PHY 105 for course description.
Corequisites: PHY 105

PHY 121 - General Physics I
Credit Hours: 4, **Contact Hours: 6**
Division: Science Math
This is the first course in a two semester sequence in General Physics. Topics include kinematics, Newton's Laws, conservation of momentum, conservation of energy, rotational motion, oscillations, and fluids.
The laboratory covers the preceding topics in parallel with the lecture whenever possible. The development of conceptual understanding and problem solving skills is emphasized. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): MTH 122

Recommended Prerequisite(s): ENG 111

Corequisites: PHY 121L

PHY 121L - General Physics I Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See PHY 121 for course description.
Corequisites: PHY 121

PHY 122 - General Physics II
Credit Hours: 4, **Contact Hours: 6**
Division: Science Math
This course is a continuation of PHY 121. Topics include thermodynamics, waves, electricity, electric circuits, magnetism, and optics. The laboratory covers the preceding topics in parallel with the lecture whenever possible. The development of conceptual understanding and problem solving skills is emphasized. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): PHY 121, PHY 121L, MTH 122

Recommended Prerequisite(s): ENG 111

Corequisites: PHY 122L

PHY 122L - General Physics II Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See PHY 122 for course description.
Corequisites: PHY 122

PHY 221 - Problems & Princ.of Physics I
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
This course is the first semester of a two-semester course sequence primarily intended for those students preparing for engineering, science, or math careers. Topics include kinematics, Newton's Laws, conservation of momentum, conservation of energy, rotational motion, oscillations, and fluids. The development of conceptual understanding and problem-solving skills are emphasized. Computers are used for data acquisition and analysis. The laboratory covers the preceding topics in parallel with the lecture whenever possible. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): MTH 141, may be taken concurrently

Recommended Prerequisite(s): ENG 111

Corequisites: PHY 221L, PHY 221R

PHY 221L - Prob./Prin. of Physics I Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See PHY 221 for course description.
Corequisites: PHY 221, PHY 221R

PHY 221R - Prob.& Princ. of Physics I Rec
Credit Hours: 1, **Contact Hours: 2**
Division: Science Math
This course is a recitation to accompany lecture PHY 221. Group 1 course.
Corequisites: PHY 221, PHY 221L

PHY 222 - Prob. & Princ. of Physics II
Credit Hours: 4, **Contact Hours: 5**
Division: Science Math
This course is a continuation of PHY 221. Topics include thermodynamics, waves, electricity, electric circuits, magnetism and optics. The laboratory covers the preceding topics in parallel with the lecture whenever possible. The development of conceptual understanding and problem solving skills is emphasized. Group 1 lab course. Quantitative Reasoning.
Required Prerequisite(s): PHY 221, PHY 221L, PHY 221R, MTH 141

Recommended Prerequisite(s): ENG 111

Corequisites: PHY 222L, PHY 222R

PHY 222L - Prob./ Prin. of Physics II Lab
Credit Hours: 0, **Contact Hours: 0**
Division: Science Math
See PHY 221/222 for course description.
Corequisites: PHY 222, PHY 222R

PHY 222R - Prob. & Princ. of Physics II R
Credit Hours: 1, **Contact Hours: 2**
Division: Science Math
This course is a recitation class to accompany PHY 222. Group 1 course.
Corequisites: PHY 222, PHY 222L