PHYSICAL SCIENCES & ENGINEERING

Arlisa Richardson, Division Chair
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Courses

Prefix	Course
AIM	Artificial Intelligence and Machine Learning
AST	Astronomy
CHM	Chemistry
ECE	Engineering Science
EEE	Electrical Engineering
ELE	Electronics
ELT	Electronics Technology
GLG	Geology
GPH	Physical Geography
PHY	Physics

Career Programs

Artificial Intelligence
Artificial Intelligence and Machine Learning

Associate in Applied Science (AAS)

- Artificial Intelligence and Machine Learning, Associate in Applied Science (https://catalog.cgc.edu/educational-programs/physical-sciences-engineering/artificial-intelligence-machine-learning-aas/)

Certificate Of Completion (CCL)

- Artificial Intelligence and Machine Learning, Certificate of Completion (https://catalog.cgc.edu/educational-programs/physical-sciences-engineering/artificial-intelligence-machine-learning-ccl/)

Artificial Intelligence and Machine Learning

Matar, Habib

- M.A. Arizona State University

Astronomy

Viola, Donna

- Ph.D., University of Arizona

Chemistry

Bowles, Joachim

- B.S., Oregon State
- M.S., University of Oregon

Krishnaswamy, Sujatha

- B.S., University of Madras
- M.S., Indian Institute of Technology
- M.S., Ph.D., Vanderbilt University

McFavilen, Michael

- B.S., M.S., University of California at San Diego
- M.S., Arizona State University

Schnoebelen, Carly

- B.S., University of Arizona
- Ph.D., Purdue University

Woodrum, Brian

- B.S., Elmhurst College
- Ph.D., Arizona State University

Engineering

Matar, Bassam

- B.S., Oklahoma State University
- M.S., Northern Arizona University

Neal, Nichole

- M.S., Kettering University

Silvestri, Fanny

- B.A., Ecole Supérieure des Techniques Aéronautiques et de Construction Automobile
- M.A., University of Montreal

Geology

Michel, Carolina

- Ph.D

Geography

Santoro, Michael

- B.S., M.A., Ph.D., Arizona State University

Physics

Flaherty, Sean

- B.S., California Lutheran University
- M.N.S., Arizona State University

Pauls, Jennifer

- B.A., B.S., Bethel College
- Ph.D., University of Kansas

Richardson, Arlisa
Division Chair

- B.S., M.A., Grambling State University
- M.S., University of Texas at Dallas
- M.S., Ph.D., Arizona State University

Roman, Kathryn

- M.S.N., Arizona State University

Artificial Intelligence and Machine Learning (AIM)

AIM100 / Introduction to Artificial Intelligence
3 Credits / 3.0 Periods for Lecture
Basic concepts and applications of artificial intelligence (AI), including AI project cycles. Focus on issues surrounding AI including ethics, bias, culture, regulations, and professional expectations. Prerequisites: None.
Division: Physical Sciences and Engineering

AIM110 / Introduction to Machine Learning
3 Credits / 4.0 Periods for Lecture & Lab
Introduction to machine learning concepts and Python applications, including data acquisition, supervised and unsupervised learning, and data modeling. Prerequisites: A grade of C or better in AIM100, CIS156, and MAT206.
Division: Physical Sciences and Engineering

AIM210 / Natural Language Processing
3 Credits / 4.0 Periods for Lecture & Lab
Fundamental concepts in Natural Language Processing (NLP) and text processing. Focus on knowledge and skills necessary to create a language recognition application. Prerequisites: A grade of C or better in AIM110.
Division: Physical Sciences and Engineering

AIM220 / Artificial Intelligence for Computer Vision
3 Credits / 4.0 Periods for Lecture & Lab
Understand and apply the basic techniques to process images using OpenCV and Python libraries. Prerequisites: A grade of C or better in AIM110.
Division: Physical Sciences and Engineering

AIM230 / Artificial Intelligence for Business Solutions
3 Credits / 4.0 Periods for Lecture & Lab
Fundamentals of artificial intelligence (AI) and machine learning to support business solutions. Prerequisites: A grade of C or better in AIM210 and AIM220.
Division: Physical Sciences and Engineering

AIM240 / Artificial Intelligence Capstone Project
3 Credits / 4.0 Periods for Lecture & Lab
Focus on how a social issue is explored, brought through the Artificial Intelligence (AI) Project cycle, and delivered as a solution using the different domains of AI, including computer vision and natural language processing. Prerequisites: A grade of C or better in AIM210 and AIM220.
Division: Physical Sciences and Engineering

Astronomy (AST)

AST101 / Survey of Astronomy
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Survey of astronomy for the nontechnical student. The history, content, and evolution of the solar system and the universe in general. Astronomical principles and instrumentation. The planets, moons, sun, comets, stars and star formation, galaxies, and cosmology. Prerequisites: None.
Division: Physical Sciences and Engineering

AST106 / Life in the Universe
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Introduction to the search for life in the universe for the non-science major. Earth's location in space and time, nature of life, light and the spectrum, origin and history of the universe, origin of life on Earth and the possibility of life on other planets. Prerequisites: A grade of C or better in MAT090 or MAT091 or MAT092 or completion of higher level mathematics course, or satisfactory placement.
Crosslisted: GLG106
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

AST111 / Introduction to Solar System Astronomy
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Introduction to astronomy for the non-science major. The scientific method, properties of light, astronomical instruments, our Solar System and solar systems around other stars. Includes hands-on astronomical observations and laboratory exercises. Prerequisites: A grade of C or better in MAT092 or higher, or satisfactory district placement.
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

AST112 / Introduction to Stars, Galaxies, and Cosmology
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Introduction to astronomy for the non-science major. Structure and evolution of stars; supernovae, black holes, and quasars; nebulae; star clusters; galaxies; cosmology, including the birth and death of the universe. Prerequisites: A grade of C or better in MAT092 or higher, or satisfactory district placement. Course Notes: Note that AST111 is not a prerequisite for this course.
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

AST114 / Introduction to Stars, Galaxies, and Cosmology Laboratory
1 Credit / 3.0 Periods for Laboratory
Hands-on astronomical observations and exercises to supplement AST112. Prerequisites: A grade of C or better in AST112 and permission of Instructor or Department or Division. Course Notes: AST114 is a course intended for those students who have previously completed the corresponding lecture course. Current MCCCD students should enroll in AST112 only.
Division: Physical Sciences and Engineering

AST294AB / Special Topics in Astronomy
1 Credit / 1.0 Periods for Lecture
Conceptual, experimental, and computational aspects of a special topic in astronomy. Prerequisites: Permission of Department or Division. Course Notes: AST294AB may be repeated for credit.
Division: Physical Sciences and Engineering

Chemistry (CHM)

CHM107 / Chemistry and Society
3 Credits / 3.0 Periods for Lecture
A survey of chemistry and its impact on society and the environment. Prerequisites: None. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM107LL
Division: Physical Sciences and Engineering

CHM107LL / Chemistry and Society Laboratory
1 Credit / 3.0 Periods for Laboratory
Laboratory experience in support of CHM107. Prerequisites or Corequisites: CHM107. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM107
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM130 / Fundamental Chemistry
3 Credits / 3.0 Periods for Lecture
A survey of the fundamentals of general chemistry. Emphasis on essential concepts and problem solving techniques. Basic principles of measurement, chemical bonding, structure and reactions, nomenclature, and the chemistry of acids and bases. Preparation for students taking more advanced courses in chemistry. Designed to meet needs of students in such diverse areas as agriculture, nursing, home economics, physical education and water technology. Prerequisites: A grade of C or better in [(CHM100, or MAT090, or MAT091, or MAT092, or higher level mathematics course, or satisfactory math placement) and (RDG100, or RDG100LL, or higher, or eligibility for CRE101 as indicated by appropriate reading placement)], or permission of the Instructor, or Department or Division Chair. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM130LL
SUN SUN# CHM 1130
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM130AA / Fundamental Chemistry with Lab
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
A survey of the fundamentals of general chemistry. Emphasis on essential concepts and problem solving techniques. Basic principles of measurement, chemical bonding, structure and reactions, nomenclature, and the chemistry of acids and bases. Preparation for students taking more advanced courses in chemistry. Designed to meet needs of students in such diverse areas as agriculture, nursing, home economics, physical education and water technology. Prerequisites: A grade of C or better in [(CHM100, or MAT090, or MAT091, or MAT092, or higher level mathematics course, or satisfactory math placement) and (RDG100, or RDG100LL, or higher, or eligibility for CRE101 as indicated by appropriate reading placement)], or permission of the Instructor, or Department or Division Chair. Course Notes: Student may receive credit for only one of the following: CHM130 and CHM130LL, or CHM130AA.
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM130LL / Fundamental Chemistry Laboratory
1 Credit / 3.0 Periods for Laboratory
Laboratory experience in support of CHM130. Prerequisites or Corequisites: A grade of "C" or better in CHM130. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM130
SUN SUN# CHM 1130
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM138 / Chemistry for Allied Health
3 Credits / 3.0 Periods for Lecture
Elements of fundamental and organic chemistry. Includes the general chemical behavior of inorganic matter and the structure of organic and biochemical systems. Course designed for specific allied health programs at MCCD. May not be applicable to other allied health programs or transferable. Prerequisites: A grade of C or better in (CHM100 or MAT090 or MAT091 or MAT092 or higher or satisfactory math placement), or one year of high school chemistry taken within the last five years with a grade of C or better, or permission of the Instructor, or Department or Division Chair.
Division: Physical Sciences and Engineering

CHM138LL / Chemistry for Allied Health Laboratory
1 Credit / 3.0 Periods for Laboratory
Laboratory experience in support of CHM138, Chemistry for Allied Health. Prerequisites: None. Corequisites: CHM138.
Division: Physical Sciences and Engineering

CHM151 / General Chemistry I
3 Credits / 3.0 Periods for Lecture
Detailed study of principles of chemistry for science majors and students in pre-professional curricula. Prerequisites: A grade of C or better in [(CHM130 and CHM130LL), or CHM130AA, or one year of high school chemistry taken within the last five years] and (a grade of C or better in MAT151 or higher level mathematics course, or satisfactory placement), or permission of the Instructor, or Department or Division Chair. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM151LL. Arizona Shared Unique Number SUN#: CHM 1151. Completion of all prerequisites within the last two years is recommended. Student may receive credit for only one of the following: CHM150 and CHM151LL, or CHM151 and CHM151LL, or CHM150AA, or CHM151AA.
SUN SUN# CHM 1151
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM151AA / General Chemistry I
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Detailed study of principles of chemistry for science majors and students in pre-professional curricula. Prerequisites: A grade of C or better in [(CHM130 and CHM130LL), or CHM130AA, or one year of high school chemistry taken within the last five years] and (a grade of C or better in MAT151 or higher level mathematics course, or satisfactory placement), or permission of the Instructor, or Department or Division Chair. Course Notes: Completion of all prerequisites within the last two years is recommended. Student may receive credit for only one of the following: CHM150 and CHM151LL, or CHM151 and CHM151LL, or CHM150AA, or CHM151AA.
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM151LL / General Chemistry I Laboratory
1 Credit / 3.0 Periods for Laboratory
Laboratory experience in support of CHM150 or CHM151. Prerequisites: A grade of C or better in CHM150 or CHM151 or Corequisites: CHM150 or CHM151. Course Notes: Student may receive credit for only one of the following: CHM150 and CHM151LL, or CHM151 and CHM151LL, or CHM150AA, or CHM151AA. General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM150 or CHM151
SUN SUN# CHM 1151
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM152 / General Chemistry II
3 Credits / 3.0 Periods for Lecture
A study of the chemical properties of the major groups of elements, equilibrium theory, thermodynamics, electrochemistry, and other selected topics. Prerequisites: A grade of C or better in [(CHM150 or CHM151) and CHM151LL], or CHM150AA, or CHM151AA, or permission of the Instructor, or Department or Division Chair. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM152LL. Arizona Shared Unique Number SUN# CHM1152. Completion of prerequisites within the last two years recommended. Completion of CHM152LL required to meet the Natural Science requirement. Student may receive credit for only one of the following: CHM152 and CHM152LL, or CHM152AA.
SUN SUN# CHM 1152
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM152AA / General Chemistry II
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
A study of the chemical properties of the major groups of elements, equilibrium theory, thermodynamics, electrochemistry, and other selected topics. Prerequisites: A grade of C or better in [(CHM150 or CHM151) and CHM151LL], or CHM150AA, or CHM151AA, or permission of the Instructor, or Department or Division Chair. Course Notes: Completion of prerequisites within the last two years recommended. Student may receive credit for only one of the following: CHM152 and CHM152LL, or CHM152AA.
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM152LL / General Chemistry II Laboratory
1 Credit / 3.0 Periods for Laboratory
Laboratory experience in support of CHM152. Prerequisites: A grade of C or better in CHM152 or Corequisites: CHM152. Course Notes: Student may receive credit for only one of the following: CHM152 and CHM152LL, or CHM152AA. General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM152
SUN SUN# CHM 1152
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

CHM230 / Fundamental Organic Chemistry
3 Credits / 3.0 Periods for Lecture
Chemistry of representative groups of organic compounds, emphasizing biological applications. Prerequisites: A grade of C or better in (CHM130 and CHM130LL) or (CHM150 or CHM151 and CHM151LL), or permission of the Instructor, or Department or Division Chair. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM230LL. Arizona Shared Unique Number SUN#: CHM 2230. Completion of prerequisites within the last two years recommended. CHM230 course content is designed to meet the needs of students in such areas as agriculture, home economics, nursing, pre-physician assistant, and physical education among others.
Division: Physical Sciences and Engineering

CHM230LL / Fundamental Organic Chemistry Laboratory
1 Credit / 3.0 Periods for Laboratory
Laboratory experience in support of CHM230. Prerequisites: A grade of C or better in CHM130LL or CHM151LL, or equivalent. Prerequisites or Corequisites: CHM230. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: CHM230
Division: Physical Sciences and Engineering

CHM235 / General Organic Chemistry I
3 Credits / 3.0 Periods for Lecture
Rigorous introduction to chemistry of carbon-containing compounds. Reaction mechanisms and recent methods of synthesis emphasized. Prerequisites: A grade of C or better in (CHM152 and CHM152LL), or CHM152AA, or (CHM154 and CHM154LL), or permission of the Instructor, or Department or Division Chair. Course Notes: Completion of prerequisites within the last two years recommended.
SUN SUN# CHM 2235
Division: Physical Sciences and Engineering

CHM235LL / General Organic Chemistry I Laboratory
1 Credit / 4.0 Periods for Laboratory
Laboratory experience in support of CHM235. Prerequisites: A grade of C or better in CHM235 or Corequisites: CHM235. Completion of prerequisites within the last two years recommended.
SUN SUN# CHM 2235
Division: Physical Sciences and Engineering

CHM236 / General Organic Chemistry IIA
3 Credits / 3.0 Periods for Lecture
Study of chemistry of carbon-containing compounds continued. Structural determination and additional reaction mechanisms and modern methods of synthesis emphasized. Prerequisites: A grade of C or better in (CHM235 and CHM235LL) or CHM235AA, or permission of the Instructor, or Department or Division Chair. Course Notes: Completion of prerequisites within the last two years recommended.
Division: Physical Sciences and Engineering

CHM236LL / General Organic Chemistry IIA Laboratory
1 Credit / 4.0 Periods for Laboratory
Laboratory experience in support of CHM236. Prerequisites: A grade of C or better in CHM236 or Corequisites: CHM236. Completion of prerequisites within the last two years recommended.
SUN SUN# CHM 2236
Division: Physical Sciences and Engineering

CHM260 / Fundamental Biochemistry
3 Credits / 3.0 Periods for Lecture
Structures, properties, and functions of proteins, enzymes, nucleic acids, carbohydrates and lipids; the utilization and synthesis of these materials by living systems and the relationship of the processes to energy production and utilization. Prerequisites: A grade of C or better in [(CHM230 and CHM230LL) or CHM230AA], or [(CHM235 and CHM235LL) or CHM235AA], or permission of the Instructor, or Department or Division Chair. Course Notes: Completion of prerequisites within the last two years recommended. Designed for students in agriculture, dental hygiene, home economics, nursing, and physical therapy.
Division: Physical Sciences and Engineering

Engineering Science (ECE)

ECE102 / Engineering Analysis Tools and Techniques
2 Credits / 4.0 Periods for Lecture & Lab
Learning culture of engineering, engineering use of computer tools, and computer modeling as applied to engineering analysis and design. Prerequisites: A grade of C or better in MAT15+ or higher-level mathematics course, or permission of Instructor or Division or Department Chair.
Division: Physical Sciences and Engineering

ECE103 / Engineering Problem Solving and Design
2 Credits / 4.0 Periods for Lecture & Lab
Fundamentals of the design process: engineering modeling, communication and problem-solving skills in a team environment. Emphasis on process-based improvements to the design process. Introduction to engineering as a profession. Prerequisites: A grade of C or better in ECE102 or permission of Instructor or Division or Department Chair. Course Notes: Student may receive credit for only one of the following: ECE103 or ECE103EP.
SUN SUN# EGR 1102
Division: Physical Sciences and Engineering

ECE105 / MATLAB Programming
1 Credit / 2.0 Periods for Lecture & Lab
Use MATLAB to solve engineering problems. An overview of programming, including matrices, structures, strings, functions, control flow, file management, data analysis, graphing capabilities, and mathematical calculations. Prerequisites: A grade of C or better in [(MAT150 or MAT151 or MAT152 or MAT155 or MAT156) and MAT182] or MAT187 or higher level mathematics course or permission of Instructor or Division or Department Chair.
Division: Physical Sciences and Engineering

ECE150 / Exploring Engineering and its Impact on Society
3 Credits / 3.0 Periods for Lecture
Introduction to the profession of engineering and its impact on culture and society. Prerequisites: None.
Division: Physical Sciences and Engineering

ECE211 / Engineering Mechanics-Statics
3 Credits / 2.0 Periods for Laboratory, 3.0 Periods for Lecture
Modeling of static equilibrium in particles and rigid bodies through analysis of forces and mechanical properties. Prerequisites: A grade of C or better in PHY115 or PHY121 or permission of Instructor or Division or Department Chair. Corequisites: MAT230 or MAT231 or permission of Instructor or Division or Department Chair.
Division: Physical Sciences and Engineering

ECE212 / Engineering Mechanics-Dynamics
3 Credits / 2.0 Periods for Laboratory, 3.0 Periods for Lecture
Kinematics and kinetics of particles, translating and rotating coordinate systems, rigid body kinematics, dynamics of systems of particles and rigid bodies, and energy and momentum principles. A grade of C or better required in all Prerequisites. Prerequisites: [ECE211 and (PHY115 or PHY121)] or permission of Instructor or Division or Department Chair. Prerequisites or Corequisites: MAT240 or MAT241 or permission of Instructor or Division or Department Chair.
Division: Physical Sciences and Engineering

ECE215 / Mechanics of Materials
3 Credits / 5.0 Periods for Lecture & Lab
Designed to provide students with a strong fundamental foundation in the mechanics of solids. Includes the concepts of stress and strain applied to the analysis and design of members subjected to axial and torsional loads and members subjected to shear and bending, applications and transformation of plane stress and plane strain, deformation of beams, and elastic buckling of columns. Prerequisites: A grade of C or better in ECE211 or ECE214 or permission of Instructor or Division or Department Chair.
Division: Physical Sciences and Engineering

ECE216 / Computer-Aided Engineering
2 Credits / 2.0 Periods for Lecture
Introduction to engineering graphics, including tolerancing and fasteners, as well as creation and use of engineering drawings. Prerequisites: A grade of C or better in ECE103, or ECE103EP, or permission of Instructor or Division or Department Chair. Corequisites: ECE216LL.
Division: Physical Sciences and Engineering

ECE216LL / Computer-Aided Engineering Laboratory
1 Credit / 2.0 Periods for Laboratory
Laboratory experience in support of ECE216. Prerequisites: A grade of C or better in ECE103, or ECE103EP, or permission of Instructor. Corequisites: ECE216.
Division: Physical Sciences and Engineering

ECE280 / Foundational Statistics for Engineers
3 Credits / 5.0 Periods for Lecture & Lab
Fundamentals of probability, descriptive statistics, sampling distributions, parameter estimation, tests of hypotheses, regression analysis, analysis of variance, and design of experiments. Prerequisites: A grade of C or better in MAT220, or MAT221, or equivalent.
Crosslisted: MAT280
Division: Physical Sciences and Engineering

Electrical Engineering (EEE)

EEE120 / Digital Design Fundamentals
4 Credits / 6.0 Periods for Lecture & Lab
Number systems, conversion methods, binary and complement arithmetic, Boolean switching algebra and circuit minimization techniques. Analysis and design of combinational logic, flip-flops, simple counters, registers, ROMs, PLDs, synchronous and asynchronous sequential circuits, and state reduction techniques. Building physical circuits. Prerequisites: None. Corequisites: CSC100 or CSC110 or permission of Instructor or Division or Department Chair.
Crosslisted: CSC120
Fulfills: Computer/Statistics/Quantitative Applications [CS]; Computer/Stats/Quantitative Apps [CS]-in combo
Division: Physical Sciences and Engineering

EEE202 / Circuits and Devices
5 Credits / 3.0 Periods for Laboratory, 4.0 Periods for Lecture
Introduction to circuits and devices. Component models, transient analysis, steady state analysis, Laplace transform, and active and passive filter networks. Prerequisites: A grade of C or better in PHY116 or PHY131 or permission of Instructor or Division or Department Chair. Corequisites: MAT276 or permission of Instructor or Division or Department Chair.
Division: Physical Sciences and Engineering

EEE230 / Computer Organization and Assembly Language
4 Credits / 5.0 Periods for Lecture & Lab
Assembly language programming including input/output (I/O) programming and exception/interrupt handling. Register-level computer organization, I/O interfaces, assemblers, and linkers. Processor organization and design, data path, control, pipelining, and input/output. Memory organization with cache and virtual memory. Prerequisites: A grade of C or better in [(CSC100 or CSC110) and CSC/EEE120], or permission of Instructor or Division or Department Chair.
Crosslisted: CSC230
Division: Physical Sciences and Engineering

Geology (GLG)

GLG101 / Introduction to Geology I - Physical Lecture
3 Credits / 3.0 Periods for Lecture
Introduction to Earth's materials, surface and internal geologic processes, plate tectonics and geologic time. Prerequisites: None. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: GLG103. Arizona Shared Unique Number SUN#: GLG 1101. Students may receive credit for only one of the following: GLG101 or GLG101IN.
SUN SUN# GLG 1101
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

GLG102 / Introduction to Geology II - Historical Lecture
3 Credits / 3.0 Periods for Lecture
The origin and history of the Earth, its dynamic geographic and climatic changes. Evolution and sequence of life recorded in the fossil record; tectonic evolution of major continents through time. Prerequisites: None. Course Notes: General Education Designation: Historical Awareness - [H]. General Education Designation: Natural Sciences (General) - [SG] in combination with: GLG104. Students may receive credit for only one of the following: GLG102 or GLG102IN.
Fulfills: Historical Awareness [H]; Historical Awareness [H]-in combo; Natural Sciences General [SG]; Natural Sciences General [SG]-in combo
Division: Physical Sciences and Engineering

GLG103 / Introduction to Geology I - Physical Lab
1 Credit / 3.0 Periods for Laboratory
Includes practical experience in rock and mineral identification, topographic maps, and applied problems in geology. Prerequisites: None. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: GLG101. Arizona Shared Unique Number SUN#: GLG 1101. May accompany GLG101. Students may receive credit for only one of the following: GLG103 or GLG101IN.
SUN SUN# GLG 1101
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

GLG104 / Introduction to Geology II - Historical Lab
1 Credit / 3.0 Periods for Laboratory
The study of minerals, rocks, fossils, geologic maps and structures. Prerequisites: None. Course Notes: General Education Designation: Natural Sciences (General) - [SG] in combination with: GLG102. May accompany GLG102. Students may receive credit for only one of the following: GLG104 or GLG102IN.
Fulfills: Natural Sciences General [SG]; Natural Sciences General [SG]-in combo
Division: Physical Sciences and Engineering

GLG110 / Geological Disasters and the Environment
3 Credits / 3.0 Periods for Lecture
Acquaints students with the use and importance of geological studies as they apply to the interactions between people and the earth. Includes geological processes and hazards such as earthquakes, volcanoes, floods and landslides. Examines environmental impact and use of mineral and energy resources. Prerequisites: None. Course Notes: General Education Designation: Global Awareness - [G]. General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with GLG111. Students may receive credit for only one of the following: GLG110 or GLG110IN.
Fulfills: Global Awareness [G]; Global Awareness [G]-in combo; Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

GLG111 / Geological Disasters and the Environment Lab
1 Credit / 3.0 Periods for Laboratory
Introduction to geological processes and concepts. Application of basic geologic knowledge to evaluate, interpret and propose solutions for a variety of current and past geology-related environmental disasters and hazards. Prerequisites: None. Course Notes: General Education Designation: Global Awareness - [G] in combination with GLG110. General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with GLG110. May accompany GLG110. Students may receive credit for only one of the following: GLG111 or GLG110IN.
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo; Global Awareness [G]; Global Awareness [G]-in combo
Division: Physical Sciences and Engineering

GLG230AA / Field Geology of the Southwest
1 Credit / 5.0 Periods for Laboratory
Field trips to selected areas in the Southwest, such as Arizona, Utah, California, and Sonora to observe and interpret various geological features and phenomena. Prerequisites: None. GLG103 suggested but not required. Course Notes: GLG230AA may be repeated for a total of four (4) credit hours.
Division: Physical Sciences and Engineering

Geography (GPH)

GPH113 / Introduction to Physical Geography
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Earth's physical processes and impacts on human environments via the atmosphere, biosphere, lithosphere and hydrosphere. Topics and practical experiences include severe weather, climate change, biomes and ecosystems, landform processes; mountain building and erosion by rivers, glaciers, waves and wind, topographic maps. Prerequisites: None.
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

GPH212 / Introduction to Meteorology I
3 Credits / 3.0 Periods for Lecture
Atmospheric processes and elements. General and local circulation, heat exchange and atmospheric moisture. Prerequisites: None. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: GPH214
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

GPH214 / Introduction to Meteorology Laboratory I
1 Credit / 3.0 Periods for Laboratory
Basic meteorological and climatological measurements. Prerequisites: None. Corequisites: GPH212. Course Notes: General Education Designation: Natural Sciences (Quantitative) - [SQ] in combination with: GPH212
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

Physics (PHY)

PHY101 / Introduction to Physics
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
A survey of physics emphasizing applications of physics to modern life. Prerequisites: A grade of C or better in MAT090, or higher level mathematics course, or eligibility for MAT120 or higher as indicated by appropriate placement. Course Notes: Students may receive credit for only one of the following: PHY101 or PHY101AA.
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

PHY111 / General Physics I
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Includes motion, energy, and properties of matter. Prerequisites: A grade of C or better in MAT182 or MAT187 or MAT220 or MAT221 or eligibility for MAT220 as indicated by appropriate placement or one year high school Trigonometry with a grade of C or better or permission of Department or Division. Course Notes: PHY111 is recommended for preprofessional and suggested for certain other majors. Students may receive credit for only one of the following: PHY111 or PHY111AA.
SUN SUN# PHY 1111
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

PHY112 / General Physics II
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Includes electricity, electromagnetism, and modern physics. Prerequisites: A grade of C or better in PHY111.
SUN SUN# PHY 1112
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

PHY121 / University Physics I: Mechanics
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Kinematics, Newton's laws, work, energy, momentum, conservation laws, dynamics of particles, solids, fluids, mechanical waves, and sound. Prerequisites: A grade of C or better in MAT220 or MAT221 or permission of Department or Division. One year of High School physics or PHY111 and PHY112 suggested but not required.
SUN SUN# PHY 1121
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

PHY131 / University Physics II: Electricity and Magnetism
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Electric charge and current, electric and magnetic fields in vacuum and in materials, and induction. AC circuits, displacement current, and electromagnetic waves. Prerequisites: A grade of C or better in MAT230 or MAT231 or permission of Department or Division and PHY121. Corequisites: MAT241 or permission of Department or Division.
SUN SUN# PHY 1131
Fulfills: Natural Sciences Quantitative [SQ]; Natural Sciences Quantitative [SQ]-in combo
Division: Physical Sciences and Engineering

PHY241 / University Physics III: Thermodynamics, Optics, and Wave Phenomena
4 Credits / 3.0 Periods for Laboratory, 3.0 Periods for Lecture
Heat, entropy, and laws of thermodynamics; wave propagation; geometrical and physical optics; introduction to special relativity. Prerequisites: A grade of C or better in PHY116 or PHY131 or permission of Instructor.
Division: Physical Sciences and Engineering