

## **Course Descriptions for Transfer Agreements**

**Calculus I, II, III**  
**"C" Programming**  
**Differential Equations**  
**Discrete Math**  
**Dynamics**  
**Electrical Circuits I**  
**Electrical Circuits I Lab**  
**Engineering Economics**  
**Engineering Graphics I**  
**Fundamentals of Circuit Analysis**  
**Fundamentals of Circuit Analysis Lab**  
**General Chemistry I, II**  
**General Chemistry Laboratory I, II**  
**Introduction to Digital Systems**  
**Introduction to Digital Systems Lab**  
**Introduction to Engineering**  
**Linear Algebra**  
**Plane Surveying**  
**Statics**  
**University Physics I**  
**University Physics I, II**  
**University Physics Laboratory I, II**

Notes:

1. The addition to the ACGM of student learning outcomes for the course University Physics I was approved by the ACGM Committee on March 31, 2010; these outcomes were revised to add the learning outcome "Solve problems involving the First and Second Laws of Thermodynamics" by the ACGM Committee on October 5, 2011.
2. The addition to the ACGM of the courses Electrical Circuits I and Electrical Circuits I Lab, and, in turn, the deletion from the ACGM of the courses Fundamentals of Circuit Analysis and Fundamentals of Circuit Analysis Laboratory was approved by the ACGM Committee on October 5, 2011.

<b>Title:</b> <b>TCCN:</b>	<b>Calculus I</b> <b>MATH 2413</b>
<b>Course Description</b>	<p>Limits and continuity; the Fundamental Theorem of Calculus; definition of the derivative of a function and techniques of differentiation; applications of the derivative to maximizing or minimizing a function; the chain rule, mean value theorem, and rate of change problems; curve sketching; definite and indefinite integration of algebraic, trigonometric, and transcendental functions, with an application to calculation of areas.</p> <p>Prerequisite: MATH 2412—Pre-Calculus Math or equivalent preparation</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Develop solutions for tangent and area problems using the concepts of limits, derivatives, and integrals.</li> <li>2. Draw graphs of algebraic and transcendental functions considering limits, continuity, and differentiability at a point.</li> <li>3. Determine whether a function is continuous and/or differentiable at a point using limits.</li> <li>4. Use differentiation rules to differentiate algebraic and transcendental functions.</li> <li>5. Identify appropriate calculus concepts and techniques to provide mathematical models of real-world situations and determine solutions to applied problems.</li> <li>6. Evaluate definite integrals using the Fundamental Theorem of Calculus.</li> <li>7. Articulate the relationship between derivatives and integrals using the Fundamental Theorem of Calculus.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Calculus II</b> <b>MATH 2414</b>
<b>Course Description</b>	<p>Differentiation and integration of transcendental functions; parametric equations and polar coordinates; techniques of integration; sequences and series; improper integrals.</p> <p>Prerequisite: MATH 2413—Calculus I</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Use the concepts of definite integrals to solve problems involving area, volume, work, and other physical applications.</li> <li>2. Use substitution, integration by parts, trigonometric substitution, partial fractions, and tables of anti-derivatives to evaluate definite and indefinite integrals.</li> <li>3. Define an improper integral.</li> <li>4. Apply the concepts of limits, convergence, and divergence to evaluate some classes of improper integrals.</li> <li>5. Determine convergence or divergence of sequences and series.</li> <li>6. Use Taylor and MacLaurin series to represent functions.</li> <li>7. Use Taylor or MacLaurin series to integrate functions not integrable by conventional methods.</li> <li>8. Use the concept of polar coordinates to find areas, lengths of curves, and representations of conic sections.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Calculus III</b> <b>MATH 2415</b>
<b>Course Description</b>	<p>Advanced topics in calculus, including vectors and vector-valued functions, partial differentiation, Lagrange multipliers, multiple integrals, and Jacobians; application of the line integral, including Green's Theorem, the Divergence Theorem, and Stokes' Theorem.</p> <p>Prerequisite: MATH 2414—Calculus II</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Perform calculus operations on vector-valued functions, including derivatives, integrals, curvature, displacement, velocity, acceleration, and torsion.</li> <li>2. Perform calculus operations on functions of several variables, including partial derivatives, directional derivatives, and multiple integrals.</li> <li>3. Find <i>extrema</i> and tangent planes.</li> <li>4. Solve problems using the Fundamental Theorem of Line Integrals, Green's Theorem, the Divergence Theorem, and Stokes' Theorem.</li> <li>5. Apply the computational and conceptual principles of calculus to the solutions of real-world problems.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>"C" Programming</b> <b>COSC 1320</b>
<b>Course Description</b>	<p>Introduces the fundamental concepts of structured programming in the C language. Topics include data types; control structures; functions, structures, arrays, pointers, pointer arithmetic, unions, and files; the mechanics of running, testing, and debugging programs; introduction to programming; and introduction to the historical and social context of computing.</p> <p>Prerequisite: None</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Analyze and explain the behavior of simple programs involving the fundamental programming constructs.</li> <li>2. Modify and expand short programs that use standard conditional and iterative control structures and functions; choose appropriate conditional and iteration constructs for a given programming task.</li> <li>3. Design, implement, test, and debug a program that uses each of the following fundamental programming constructs: basic computation, simple I/O, standard conditional and iterative structures, and the definition of functions.</li> <li>4. Apply the techniques of structured (functional) decomposition to break a program into smaller pieces.</li> <li>5. Describe the mechanics of parameter passing and demonstrate the difference between call-by-value and call-by-reference parameter passing.</li> <li>6. Discuss the importance of algorithms in the problem-solving process, identify the necessary properties of good algorithms, and create algorithms for solving simple problems.</li> <li>7. Use pseudocode or a programming language to implement, test, and debug algorithms for solving simple problems.</li> <li>8. Discuss the representation and use of primitive data types and built-in data structures.</li> <li>9. Explain the reasons for using different formats to represent numerical data.</li> <li>10. Explain basic concepts of secure programming functions.</li> <li>11. Discuss the properties of good software design.</li> <li>12. Describe the phases of program translation from source code to executable code and the files produced by these phases; explain the software life cycle and its phases, including the deliverables that are produced.</li> <li>13. Identify and describe the properties of a variable such as its associated address, value, scope, persistence, and size.</li> <li>14. Explain how abstraction mechanisms support the creation of reusable software components.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Differential Equations</b> <b>MATH 2320</b>
<b>Course Description</b>	<p>Ordinary differential equations, including linear equations, systems of equations, equations with variable coefficients, existence and uniqueness of solutions, series solutions, singular points, transform methods, and boundary value problems; application of differential equations to real-world problems.</p> <p>Prerequisite: MATH 2414—Calculus II</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Identify homogeneous equations, homogeneous equations with constant coefficients, and exact and linear differential equations.</li> <li>2. Solve ordinary differential equations and systems of equations using: <ol style="list-style-type: none"> <li>a) Direct integration</li> <li>b) Separation of variables</li> <li>c) Reduction of order</li> <li>d) Methods of undetermined coefficients and variation of parameters</li> <li>e) Series solutions</li> <li>f) Operator methods for finding particular solutions</li> <li>g) Laplace transform methods</li> </ol> </li> <li>3. Determine particular solutions to differential equations with given boundary conditions or initial conditions.</li> <li>4. Analyze real-world problems in fields such as Biology, Chemistry, Economics, Engineering, and Physics, including problems related to population dynamics, mixtures, growth and decay, heating and cooling, electronic circuits, and Newtonian mechanics.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Discrete Mathematics</b> <b>MATH 2305/2405</b>
<b>Course Description</b>	<p>A course designed to prepare math, computer science, and engineering majors for a background in abstraction, notation, and critical thinking for the mathematics most directly related to computer science. Topics include: logic, relations, functions, basic set theory, countability and counting arguments, proof techniques, mathematical induction, combinatorics, discrete probability, recursion, sequence and recurrence, elementary number theory, graph theory, and mathematical proof techniques.</p> <p>Prerequisite: MATH 2313/2413/2513—Calculus I</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Construct mathematical arguments using logical connectives and quantifiers.</li> <li>2. Verify the correctness of an argument using propositional and predicate logic and truth tables.</li> <li>3. Demonstrate the ability to solve problems using counting techniques and combinatorics in the context of discrete probability.</li> <li>4. Solve problems involving recurrence relations and generating functions.</li> <li>5. Use graphs and trees as tools to visualize and simplify situations.</li> <li>6. Perform operations on discrete structures such as sets, functions, relations, and sequences.</li> <li>7. Construct proofs using direct proof, proof by contraposition, proof by contradiction, proof by cases, and mathematical induction.</li> <li>8. Apply algorithms and use definitions to solve problems to prove statements in elementary number theory.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Engineering Mechanics: Dynamics</b> <b>ENGR 2302</b>
<b>Course Description</b>	<p>Basic theory of engineering mechanics, using calculus, involving the motion of particles, rigid bodies, and systems of particles; Newton's Laws; work and energy relationships; principles of impulse and momentum; application of kinetics and kinematics to the solution of engineering problems.</p> <p>Prerequisite: ENGR 2301—Engineering Mechanics: Statics</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Express dynamic quantities as vectors in terms of Cartesian components, polar coordinates, and normal-tangential coordinates.</li> <li>2. Compute mass moments of inertia for systems of particles and rigid bodies.</li> <li>3. Solve kinematic problems involving rectilinear and curvilinear motion of particles.</li> <li>4. Solve kinetic problems involving a system of particles using Newton's Second Law.</li> <li>5. Apply the principles of work and energy, conservation of energy, impulse and momentum, and conservation of momentum to the solution of engineering problems involving particles and systems of particles.</li> <li>6. Solve kinematic problems involving the translation and rotation of a rigid body.</li> <li>7. Solve kinetic problems involving planar translation and rotation of rigid bodies.</li> <li>8. Apply the principles of work and energy, conservation of energy, impulse and momentum, and conservation of momentum to the solution of engineering problems involving rigid bodies in planar motion.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Electrical Circuits I</b> <b>ENGR 2305</b>
<b>Course Description</b>	<p>Principles of electrical circuits and systems. Basic circuit elements (resistance, inductance, mutual inductance, capacitance, independent and dependent controlled voltage, and current sources). Topology of electrical networks; Kirchhoff 's laws; node and mesh analysis; DC circuit analysis; operational amplifiers; transient and sinusoidal steady-state analysis; AC circuit analysis; first- and second-order circuits; Bode plots; and use of computer simulation software to solve circuit problems.</p> <p>Prerequisites: PHYS 2325—University Physics I; PHYS 2125—University Physics I Laboratory; MATH 2414—Calculus II</p> <p>Prerequisite or Co-requisite: MATH 2320—Differential Equations</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Explain basic electrical concepts, including electric charge, current, electrical potential, electrical power, and energy.</li> <li>2. Apply concepts of electric network topology: nodes, branches, and loops to solve circuit problems, including the use of computer simulation.</li> <li>3. Analyze circuits with ideal, independent, and controlled voltage and current sources.</li> <li>4. Apply Kirchhoff's voltage and current laws to the analysis of electric circuits.</li> <li>5. Explain the relationship of voltage and current in resistors, capacitors, inductors, and mutual inductors.</li> <li>6. Derive and solve the governing differential equations for a time-domain first-order and second-order circuit, including singularity function source models.</li> <li>7. Determine the Thevenin or Norton equivalent of a given network that may include passive devices, dependent sources, and independent sources in combination.</li> <li>8. Analyze first and second order AC and DC circuits for steady-state and transient response in the time domain and frequency domain.</li> <li>9. Derive relations for and calculate the gain and input impedance of a given operational amplifier circuit for both DC and frequency domain AC circuits using an ideal operational amplifier model.</li> <li>10. Apply computer mathematical and simulation programs to solve circuit problems.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Electrical Circuits I Laboratory</b> <b>ENGR 2105</b>
<b>Course Description</b>	<p>Laboratory experiments supporting theoretical principles presented in ENGR 2305 involving DC and AC circuit theory, network theorems, time, and frequency domain circuit analysis. Introduction to principles and operation of basic laboratory equipment; laboratory report preparation.</p> <p>Co-requisite: ENGR 2305—Electrical Circuits I</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner.</li> <li>2. Conduct basic laboratory experiments involving electrical circuits using laboratory test equipment such as multimeters, power supplies, signal generators, and oscilloscopes.</li> <li>3. Explain the concepts of Thévenin-equivalent circuits and linear superposition and apply them to laboratory measurements.</li> <li>4. Predict and measure the transient and sinusoidal steady-state responses of simple RC and RLC circuits.</li> <li>5. Predict the behavior and make measurements of simple operational-amplifier circuits.</li> <li>6. Relate physical observations and measurements involving electrical circuits to theoretical principles.</li> <li>7. Evaluate the accuracy of physical measurements and the potential sources of error in the measurements.</li> </ol>

Note: Electric Circuits I and Electric Circuits I Laboratory can be taught as a single 4-SCH course.

<b>Title:</b> <b>TCCN:</b>	<b>Engineering Economics</b> <b>ENGR 2308</b>
<b>Course Description</b>	<p>Methods used for determining the comparative financial desirability of engineering alternatives. Provides the student with the basic tools required to analyze engineering alternatives in terms of their worth and cost, an essential element of engineering practice. The student is introduced to the concept of the time value of money and the methodology of basic engineering economy techniques. The course will address some aspects of sustainability and will provide the student with the background to enable them to pass the Engineering Economy portion of the Fundamentals of Engineering exam.</p> <p>Prerequisites: MATH 2413—Calculus I</p> <p>Prerequisites or Co-requisites: ECON 2301—Principles of Macroeconomics or ECON 2302—Principles of Microeconomics</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Apply different methods to calculate the time value of money.</li> <li>2. Construct cash flow diagrams for a given problem.</li> <li>3. Estimate total revenue, total cost, and break even points.</li> <li>4. Calculate the uniform series payment, given principal, interest rate, and pay period.</li> <li>5. Perform project evaluation, including cost/benefit analysis.</li> <li>6. Articulate principles of taxation and depreciation.</li> <li>7. Perform capital budgeting, cost comparisons, and replacement analyses.</li> <li>8. Solve problems at a level consistent with expectations of the engineering economics portion of the Fundamentals of Engineering exam.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Engineering Graphics I</b> <b>ENGR 1204/1304</b>
<b>Course Description</b>	<p>Introduction to computer-aided drafting using CAD software and sketching to generate two- and three-dimensional drawings based on the conventions of engineering graphical communication; topics include spatial relationships, multi-view projections and sectioning, dimensioning, graphical presentation of data, and fundamentals of computer graphics.</p> <p>Prerequisite: MATH 1314—College Algebra or equivalent academic preparation</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Discuss the basic steps in the design process.</li> <li>2. Demonstrate proficiency in freehand sketching.</li> <li>3. Demonstrated proficiency in geometric modeling and computer aided drafting and design (CADD).</li> <li>4. Communicate design solutions through sketching and computer graphics software using standard graphical representation methods.</li> <li>5. Solve problems using graphical geometry, projection theory, visualization methods, pictorial sketching, and geometric (solid) modeling techniques.</li> <li>6. Demonstrate proper documentation and data reporting practices.</li> <li>7. Complete a project involving creation of 3D rapid prototype models.</li> <li>8. Function as part of a design team as a team leader and as a team member.</li> </ol>

Note: Students who complete this course may need to gain knowledge on their own if a different software package is used at the receiving institution.

<b>Title:</b> <b>TCCN:</b>	<b>Fundamentals of Circuit Analysis</b> <b>ENGR 2307</b>
<b>Course Description</b>	<p>Basic concepts of electrical engineering using calculus; the fundamentals of electrical and electronic components and circuits, circuit analysis, network principles, motors, and steady-state and transient responses; application of Laplace transforms; and use of computational software to solve network problems; application of the principles to the solution of electrical engineering problems; relationship between basic principles and advanced applications.</p> <p>Co-requisite: ENGR 2107—Fundamentals of Circuit Analysis Laboratory</p> <p>Prerequisite: PHYS 2326—University Physics II</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Define basic electrical concepts, including electrical potential, electrical current, and electrical power.</li> <li>2. Discuss concepts of electrical network topology, including nodes, branches, and loops.</li> <li>3. State the characteristics of ideal independent and controlled voltage and current sources.</li> <li>4. Define the relationship of voltage and current in resistors, capacitors, inductors, and mutual inductors.</li> <li>5. Use Kirchhoff's laws in the analysis of electrical circuits.</li> <li>6. Articulate the concepts of Thévenin and Norton equivalent circuits, and apply the concepts to circuit analysis.</li> <li>7. Analyze first and second order AC and DC circuits for steady-state and transient response.</li> <li>8. Analyze simple operational amplifier circuits using an ideal operational amplifier model.</li> <li>9. Apply basic transformer models, including voltage and current relationships to turns ratio, circuit components, and reflected impedance calculations in engineering problems.</li> </ol>

Note: Fundamentals of Circuit Analysis and Fundamentals of Circuit Analysis Laboratory can be taught as a single 4-SCH course.

<b>Title:</b> <b>TCCN:</b>	<b>Fundamentals of Circuit Analysis Laboratory</b> <b>ENGR 2107</b>
<b>Course Description</b>	<p>Basic laboratory experiments supporting theoretical principles presented in ENGR 2307 involving electrical and electronic components and circuits, including circuit analysis, network principles, motors, and steady-state and transient responses, and preparation of laboratory reports.</p> <p>Co-requisite: ENGR 2307—Fundamentals of Circuit Analysis</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner.</li> <li>2. Conduct basic laboratory experiments involving electrical circuits.</li> <li>3. Relate physical observations and measurements involving electrical circuits to theoretical principles.</li> <li>4. Evaluate the accuracy of physical measurements and the potential sources of error in the measurements.</li> <li>5. Design fundamental experiments involving principles of electrical circuits.</li> <li>6. Identify appropriate sources of information for conducting laboratory experiments involving electrical circuits.</li> </ol>

Note: Fundamentals of Circuit Analysis and Fundamentals of Circuit Analysis Laboratory can be taught as a single 4-SCH course.

<b>Title:</b> <b>TCCN:</b>	<b>Chemistry I</b> <b>CHEM 1311</b>
<b>Course Description</b>	<p>Fundamental principles of chemistry and the scientific method for majors in the sciences, health sciences, and engineering; topics include measurements, fundamental properties of matter, states of matter, chemical reactions, chemical stoichiometry, periodicity of elemental properties, atomic structure, chemical bonding, molecular structure, solutions, properties of gases, and an introduction to thermodynamics and descriptive chemistry.</p> <p>Co-requisite: CHEM 1111—General Chemistry I Laboratory</p> <p>Prerequisite: MATH 1314—College Algebra or equivalent academic preparation</p> <p>High school chemistry is strongly recommended.</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Define the fundamental properties of matter.</li> <li>2. Classify matter, compounds, and chemical reactions.</li> <li>3. Determine the basic nuclear and electronic structure of atoms.</li> <li>4. Identify trends in chemical and physical properties of the elements using the Periodic Table.</li> <li>5. Describe the bonding in and the shape of simple molecules and ions.</li> <li>6. Solve stoichiometric problems.</li> <li>7. Write chemical formulas.</li> <li>8. Write and balance equations.</li> <li>9. Use the rules of nomenclature to name chemical compounds.</li> <li>10. Define the types and characteristics of chemical reactions.</li> <li>11. Use the gas laws and basics of the Kinetic Molecular Theory to solve gas problems.</li> <li>12. Determine the role of energy in physical changes and chemical reactions.</li> <li>13. Convert units of measure and demonstrate dimensional analysis skills.</li> </ol>

Note: Chemistry I and Chemistry I Laboratory can be taught as a single 4-SCH course.

<b>Title:</b> <b>TCCN:</b>	<b>Chemistry I Laboratory</b> <b>CHEM 1111</b>
<b>Course Description</b>	<p>Basic laboratory experiments supporting theoretical principles presented in CHEM 1311; introduction of the scientific method, experimental design, data collection and analysis, and preparation of laboratory reports.</p> <p>Co-requisite: CHEM 1311—General Chemistry I</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Use basic apparatus and apply experimental methodologies used in the chemistry laboratory.</li> <li>2. Demonstrate safe and proper handling of laboratory equipment and chemicals.</li> <li>3. Conduct basic laboratory experiments with proper laboratory techniques.</li> <li>4. Make careful and accurate experimental observations.</li> <li>5. Relate physical observations and measurements to theoretical principles.</li> <li>6. Interpret laboratory results and experimental data, and reach logical conclusions.</li> <li>7. Record experimental work completely and accurately in laboratory notebooks and communicate experimental results clearly in written reports.</li> <li>8. Design fundamental experiments involving principles of chemistry.</li> <li>9. Identify appropriate sources of information for conducting laboratory experiments involving principles of chemistry.</li> </ol>

Note: Chemistry I and Chemistry I Laboratory can be taught as a single 4-SCH course.

<b>Title:</b> <b>TCCN:</b>	<b>Chemistry II</b> <b>CHEM 1312</b>
<b>Course Description</b>	<p>Chemical equilibrium; phase diagrams and spectrometry; acid-base concepts; thermodynamics; kinetics; electrochemistry; nuclear chemistry; an introduction to organic chemistry and descriptive inorganic chemistry.</p> <p>Co-requisite: CHEM 1112—General Chemistry II Laboratory</p> <p>Prerequisite: CHEM 1311—General Chemistry I and CHEM 1111—General Chemistry I Laboratory, or CHEM 1411—General Chemistry I (Lecture and Laboratory)</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. State the characteristics of liquids and solids, including phase diagrams and spectrometry.</li> <li>2. Articulate the importance of intermolecular interactions and predict trends in physical properties.</li> <li>3. Identify the characteristics of acids, bases, and salts, and solve problems based on their quantitative relationships.</li> <li>4. Identify and balance oxidation-reduction equations, and solve redox titration problems.</li> <li>5. Determine the rate of a reaction and its dependence on concentration, time, and temperature.</li> <li>6. Apply the principles of equilibrium to aqueous systems using LeChatelier's Principle to predict the effects of concentration, pressure, and temperature changes on equilibrium mixtures.</li> <li>7. Analyze and perform calculations with the thermodynamic functions, enthalpy, entropy, and free energy.</li> <li>8. Discuss the construction and operation of galvanic and electrolytic electrochemical cells, and determine standard and non-standard cell potentials.</li> <li>9. Define nuclear decay processes.</li> <li>10. Describe basic principles of organic chemistry and descriptive inorganic chemistry.</li> </ol>

Note 1: Chemistry II and Chemistry II Laboratory can be taught as a single 4-SCH course.

Note 2: Some mechanical engineering programs require Chemistry II in addition to Chemistry I. The student is advised to check with the school to which he or she wants to transfer for specific requirements.

<b>Title:</b> <b>TCCN:</b>	<b>Chemistry II Laboratory</b> <b>CHEM 1112</b>
<b>Course Description</b>	<p>Basic laboratory experiments supporting theoretical principles presented in CHEM 1312; introduction of the scientific method, experimental design, chemical instrumentation, data collection and analysis, and preparation of laboratory reports.</p> <p>Co-requisite: CHEM 1312—General Chemistry II</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Use basic apparatus and apply experimental methodologies used in the chemistry laboratory.</li> <li>2. Demonstrate safe and proper handling of laboratory equipment and chemicals.</li> <li>3. Conduct basic laboratory experiments with proper laboratory techniques.</li> <li>4. Make careful and accurate experimental observations.</li> <li>5. Relate physical observations and measurements to theoretical principles.</li> <li>6. Interpret laboratory results and experimental data, and reach logical conclusions.</li> <li>7. Record experimental work completely and accurately in laboratory notebooks and communicate experimental results clearly in written reports.</li> <li>8. Design fundamental experiments involving principles of chemistry and chemical instrumentation.</li> <li>9. Identify appropriate sources of information for conducting laboratory experiments involving principles of chemistry.</li> </ol>

Note 1: Chemistry II and Chemistry II Laboratory can be taught as a single 4-SCH course.

Note 2: Some engineering programs require Chemistry II in addition to Chemistry I. The student is advised to check with the school to which he or she wants to transfer for specific requirements.

<b>Title:</b> <b>TCCN:</b>	<b>Introduction to Digital Systems</b> <b>ENGR 2306</b>
<b>Course Description</b>	<p>Introduction to theory and design of digital logic, circuits, and systems. Number systems, operations and codes; logic gates; Boolean Algebra and logic simplification; Karnaugh maps; combinational logic; functions of combinational Logic; flip-flops and related devices; counters; shift registers; sequential logic; memory and storage.</p> <p>Co-requisite: ENGR 2106—Introduction to Digital Systems Laboratory</p> <p>Prerequisite: MATH 1314—College Algebra or equivalent academic preparation</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Utilize binary and hexadecimal numbers.</li> <li>2. Solve problems involving digital codes, operations, and number systems.</li> <li>3. Define, describe, and analyze fundamentals of Boolean algebra and digital logic gates.</li> <li>4. Describe, analyze, design, and fabricate combinational logic circuits.</li> <li>5. Describe, analyze, design, and fabricate sequential logic circuits.</li> <li>6. Describe and explain the fundamentals of memory operations.</li> <li>7. Apply computer mathematical and/or simulation tools to solve digital systems problems.</li> </ol>

Note: Introduction to Digital Systems and Introduction to Digital Systems Laboratory can be taught as a single 4-SCH course.

Note: Some baccalaureate engineering programs will accept the course ENGR 2306 for transfer credit and as applicable to the engineering major, while others will accept the course for transfer credit only. The student is advised to check with the school to which he or she wants to transfer for specific applicability of this course to the engineering major.

<b>Title:</b> <b>TCCN:</b>	<b>Introduction to Digital Systems Laboratory</b> <b>ENGR 2106</b>
<b>Course Description</b>	<p>Basic laboratory experiments supporting theoretical principles presented in ENGR 23XX involving design, construction, and analysis of combinational and sequential digital circuits and systems, including logic gates, adders, multiplexers, encoders, decoders, arithmetic logic units, latches, flip-flops, registers, and counters; preparation of laboratory reports.</p> <p>Co-requisite: ENGR 2306—Introduction to Digital Systems</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner.</li> <li>2. Conduct basic laboratory experiments involving design and construction of digital circuits and systems.</li> <li>3. Relate physical observations and measurements involving digital circuits and systems to theoretical principles.</li> <li>4. Evaluate the accuracy of physical measurements and the potential sources of error in the measurements.</li> <li>5. Design fundamental experiments involving principles of digital circuits and systems.</li> <li>6. Identify and apply appropriate sources of information for conducting laboratory experiments involving digital circuits and systems.</li> <li>7. Apply computer mathematical and/or simulation tools to solve digital systems problems.</li> </ol>

Note: Introduction to Digital Systems and Introduction to Digital Systems Laboratory can be taught as a single 4-SCH course.

Note: Some baccalaureate engineering programs will accept the course ENGR 2106 for transfer credit and as applicable to the engineering major, while others will accept the course for transfer credit only. The student is advised to check with the school to which he or she wants to transfer for specific applicability of this course to the engineering major.

<b>Title:</b> <b>TCCN:</b>	<b>Introduction to Engineering</b> <b>ENGR 1201</b>
<b>Course Description</b>	<p>An introduction to the engineering profession with emphasis on technical communication and team-based engineering design. One hour of lecture and three hours of laboratory each week.</p> <p>Prerequisite: MATH 1314—College Algebra or equivalent academic preparation</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Describe the engineering profession and engineering ethics, including professional practice and licensure.</li> <li>2. Use technical communication skills to explain the analysis and results of introductory laboratory exercises in engineering and computer science.</li> <li>3. Explain the engineering analysis and design process.</li> <li>4. Analyze data collected during laboratory exercises designed to expose students to the different engineering disciplines.</li> <li>5. Describe the impact engineering has had on the modern world.</li> <li>6. As part of a team, design a simple engineering device, write a design report, and present the design.</li> <li>7. Demonstrate computer literacy.</li> </ol>

Note: Some baccalaureate engineering programs will accept the course ENGR 1201 for transfer credit and as applicable to the engineering major, while others will accept the course for transfer credit only. The student is advised to check with the school to which he or she wants to transfer for specific applicability of this course to the engineering major.

<b>Title:</b> <b>TCCN:</b>	<b>Linear Algebra</b> <b>MATH 2318</b>
<b>Course Description</b>	<p>Introduces and provides models for application of the concepts of vector algebra. Topics include finite dimensional vector spaces and their geometric significance; representing and solving systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion; matrices; determinants; linear transformations; quadratic forms; eigenvalues and eigenvector; and applications in science and engineering.</p> <p>Pre-requisite: MATH 2414—Calculus II</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Be able to solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion.</li> <li>2. Be able to carry out matrix operations, including inverses and determinants.</li> <li>3. Demonstrate understanding of the concepts of vector space and subspace.</li> <li>4. Demonstrate understanding of linear independence, span, and basis.</li> <li>5. Be able to determine eigenvalues and eigenvectors and solve problems involving eigenvalues.</li> <li>6. Apply principles of matrix algebra to linear transformations. Demonstrate application of inner products and associated norms.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Plane Surveying</b> <b>ENGR 1307</b>
<b>Course Description</b>	<p>Development of skills necessary to recognize and solve problems in surveying; introduction and use of various precision instruments used for surveying, including level, theodolites, electronic distance measuring equipment, and total stations for collecting field data; introduction of Global Positioning Systems (GPS) and Geographic Information Systems (GIS) and their use in surveying; and use of graphic design software, such as AutoCAD or Microstation, in surveying problems.</p> <p>Prerequisites: MATH 1316—Plane Trigonometry or equivalent, ENGR 1304—Engineering Graphics I</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. State the different classifications and types of surveys.</li> <li>2. Apply principles of trigonometry to surveying problems.</li> <li>3. Perform necessary unit conversions in surveying.</li> <li>4. Demonstrate skills necessary for field work such as safety, note keeping, and instrument care.</li> <li>5. Operate surveying equipment such as level, theodolite, total station, electronic distance measuring equipment, and surveying tape.</li> <li>6. Determine the expected value and error bounds associated with measurements.</li> <li>7. Perform horizontal and vertical measurements using standard surveying equipment for distance, angles, and contours.</li> <li>8. Perform traverse and area calculations, including traverse closure.</li> <li>9. Perform field layout for typical civil engineering applications such as highway geometrics and land development.</li> <li>10. Present surveying data in graphical form using engineering design software such as AutoCAD or Microstation.</li> <li>11. Discuss the basic principles of GIS and GPS systems and their application to field surveying problems.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>Engineering Mechanics: Statics</b> <b>ENGR 2301</b>
<b>Course Description</b>	<p>Basic theory of engineering mechanics, using calculus, involving the description of forces, moments, and couples acting on stationary engineering structures; equilibrium in two and three dimensions; free-body diagrams; friction; centroids; centers of gravity; and moments of inertia.</p> <p>Prerequisite: PHYS 2325—University Physics I and PHYS 2125—University Physics I (Lab), or PHYS 2425—University Physics I (Lecture and Lab)</p> <p>Concurrent enrollment in or previous completion of MATH 2414—Calculus II</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. State the fundamental principles used in the study of mechanics.</li> <li>2. Define magnitude and directions of forces and moments and identify associated scalar and vector products.</li> <li>3. Draw free body diagrams for two- and three-dimensional force systems.</li> <li>4. Solve problems using the equations of static equilibrium.</li> <li>5. Compute the moment of force about a specified point or line.</li> <li>6. Replace a system of forces by an equivalent simplified system.</li> <li>7. Analyze the forces and couples acting on a variety of objects.</li> <li>8. Determine unknown forces and couples acting on objects in equilibrium.</li> <li>9. Analyze simple trusses using the method of joints or the method of sections.</li> <li>10. Determine the location of the centroid and the center of mass for a system of discrete particles and for objects of arbitrary shape.</li> <li>11. Analyze structures with a distributed load.</li> <li>12. Calculate moments of inertia for lines, areas, and volumes.</li> <li>13. Apply the parallel axis theorem to compute moments of inertia for composite regions.</li> <li>14. Solve problems involving equilibrium of rigid bodies subjected to a system of forces and moments that include friction.</li> <li>15. Solve problems involving dry sliding friction, including problems with wedges and belts.</li> </ol>

<b>Title:</b> <b>TCCN:</b>	<b>University Physics I</b> <b>PHYS 2325</b>
<b>Course Description</b>	<p>Fundamental principles of physics, using calculus, for science, computer science, and engineering majors; the principles and applications of classical mechanics, including harmonic motion and physical systems; emphasis on problem solving.</p> <p>Co-requisite: PHYS 2125—University Physics I Laboratory</p> <p>Prerequisite: MATH 2413—Calculus I</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Determine the components of linear motion (displacement, velocity, and acceleration), and especially motion under conditions of constant acceleration.</li> <li>2. Solve problems involving forces and work.</li> <li>3. Apply Newton's laws to physical problems.</li> <li>4. Identify the different types of energy.</li> <li>5. Solve problems using principles of conservation of energy.</li> <li>6. Define the principles of impulse, momentum, and collisions.</li> <li>7. Use principles of impulse and momentum to solve problems.</li> <li>8. Determine the location of the center of mass and center of rotation for rigid bodies in motion.</li> <li>9. Discuss rotational kinematics and dynamics and the relationship between linear and rotational motion.</li> <li>10. Solve problems involving rotational and linear motion.</li> <li>11. Define equilibrium, including the different types of equilibrium.</li> <li>12. Discuss simple harmonic motion and its application to real-world problems.</li> <li>13. Solve problems involving the First and Second Laws of Thermodynamics.</li> </ol>

Note: University Physics I and University Physics I Laboratory can be taught as a single 4-SCH course.

<b>Title:</b> <b>TCCN:</b>	<b>University Physics I Laboratory</b> <b>PHYS 2125</b>
<b>Course Description</b>	<p>Basic laboratory experiments supporting theoretical principles presented in PHYS 2325 involving the principles and applications of classical mechanics, including harmonic motion and physical systems; experimental design, data collection and analysis, and preparation of laboratory reports.</p> <p>Co-requisite: PHYS 2325—University Physics I</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner.</li> <li>2. Conduct basic laboratory experiments involving classical mechanics.</li> <li>3. Relate physical observations and measurements involving classical mechanics to theoretical principles.</li> <li>4. Evaluate the accuracy of physical measurements and the potential sources of error in the measurements.</li> <li>5. Design fundamental experiments involving principles of classical mechanics.</li> <li>6. Identify appropriate sources of information for conducting laboratory experiments involving classical mechanics.</li> </ol>

Note: University Physics I and University Physics I Laboratory can be taught as a single 4-SCH course.

<b>Title:</b> <b>TCCN:</b>	<b>University Physics II</b> <b>PHYS 2326</b>
<b>Course Description</b>	<p>Principles of physics for science, computer science, and engineering majors, using calculus, involving the principles of electricity and magnetism, including circuits, electromagnetism, waves, sound, light, and optics.</p> <p>Co-requisite: PHYS 2126—University Physics II Laboratory</p> <p>Prerequisites: PHYS 2325—University Physics I, MATH 2414—Calculus II</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Articulate the fundamental concepts of electricity and electromagnetism, including electrostatic potential energy, electrostatic potential, potential difference, magnetic field, induction, and Maxwell's Laws.</li> <li>2. State the general nature of electrical forces and electrical charges, and their relationship to electrical current.</li> <li>3. Solve problems involving the inter-relationship of electrical charges, electrical forces, and electrical fields.</li> <li>4. Apply Kirchhoff's Laws to analysis of circuits with potential sources, capacitance, and resistance, including parallel and series capacitance and resistance.</li> <li>5. Calculate the force on a charged particle between the plates of a parallel-plate capacitor.</li> <li>6. Apply Ohm's law to the solution of problems.</li> <li>7. Describe the effects of static charge on nearby materials in terms of Coulomb's Law.</li> <li>8. Use Faraday's and Lenz's laws to find the electromotive forces.</li> <li>9. Describe the components of a wave and relate those components to mechanical vibrations, sound, and decibel level.</li> <li>10. Articulate the principles of reflection, refraction, diffraction, interference and superposition of waves.</li> <li>11. Solve real-world problems involving optics, lenses, and mirrors.</li> </ol>

Note: University Physics II and University Physics II Laboratory can be taught as a single 4-SCH course.

<b>Title:</b> <b>TCCN:</b>	<b>University Physics II Laboratory</b> <b>PHYS 2126</b>
<b>Course Description</b>	<p>Laboratory experiments supporting theoretical principles presented in PHYS 2326 involving the principles of electricity and magnetism, including circuits, electromagnetism, waves, sound, light, and optics; experimental design, data collection and analysis, and preparation of laboratory reports.</p> <p>Co-requisite: PHYS 2326—University Physics II</p>
<b>Course Outcomes</b>	<p>Upon successful completion of this course, students will:</p> <ol style="list-style-type: none"> <li>1. Prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner.</li> <li>2. Conduct basic laboratory experiments involving electricity and magnetism.</li> <li>3. Relate physical observations and measurements involving electricity and magnetism to theoretical principles.</li> <li>4. Evaluate the accuracy of physical measurements and the potential sources of error in the measurements.</li> <li>5. Design fundamental experiments involving principles of electricity and magnetism.</li> <li>6. Identify appropriate sources of information for conducting laboratory experiments involving electricity and magnetism.</li> </ol>

Note: University Physics II and University Physics II Laboratory can be taught as a single 4-SCH course.