

## Physical Science/Math/Engineering

<b>Course Number</b>	<b>Course Title</b>	<b>Order Number</b>	<b>Student Learning Outcome</b>
ASTR 4	Solar System Astronomy		1 Appraise the benefits to society of planetary research and exploration.
ASTR 4	Solar System Astronomy		2 Compare and contrast the development of planetary systems and of the major planet types, including those factors that have led to Earth's unique characteristics.
ASTR 4	Solar System Astronomy		3 Evaluate astronomical news items or theories concerning solar system astronomy based upon the scientific method.
ASTR 10	Stellar Astronomy		1 Appraise the benefits to society of astronomical research concerning stars and stellar systems.
ASTR 10	Stellar Astronomy		2 Evaluate the impact on Earth's characteristics of the evolution of stars and stellar systems.
ASTR 10	Stellar Astronomy		3 Evaluate astronomical news items or theories about stellar astronomy based upon the scientific method.
ASTR 15L	Astronomy Laboratory		1 Evaluate claims about the nature of the physical universe using the scientific method of hypothesis testing.
ASTR 15L	Astronomy Laboratory		2 Compare and contrast the histories of solar-system bodies (e.g. moons, planets, asteroids, comets, meteorites) by integrating data from spacecraft and Earth-based observatories.
CHEM 1A	General Chemistry		1 Identify and explain trends in the periodic table.
CHEM 1A	General Chemistry		2 Construct balanced reaction equations and illustrate principles of stoichiometry.

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CHEM 1A	General Chemistry	3 Apply the first law of thermodynamics to chemical reactions.
CHEM 1B	General Chemistry	1 Evaluate the principles of molecular kinetics.
CHEM 1B	General Chemistry	2 Apply principles of chemical equilibrium to chemical reactions.
CHEM 1B	General Chemistry	3 Apply the second and third laws of thermodynamics to chemical reactions.
CHEM 1C	General Chemistry and Qualitative Analysis	1 Apply the principles of equilibrium and thermodynamics to electrochemical systems.
CHEM 1C	General Chemistry and Qualitative Analysis	2 Apply the principles of transition metal chemistry to predict outcomes of chemical reactions and physical properties.
CHEM 1C	General Chemistry and Qualitative Analysis	3 Evaluate isotopic decay pathways.
CHEM 1C	General Chemistry and Qualitative Analysis	4 Demonstrate a knowledge of intermolecular forces.
CHEM 10	Introductory Chemistry	1 Develop problem solving techniques by applying the "Scientific Method" to chemical data.
CHEM 10	Introductory Chemistry	2 Analyze and solve chemical questions utilizing information presented in the periodic table of the elements.
CHEM 10	Introductory Chemistry	3 Evaluate current scientific theories and observations utilizing a scientific mindset and an understanding of matter and the changes it undergoes.
CHEM 12A	Organic Chemistry	1 Predict the product of a chemical reaction.
CHEM 12A	Organic Chemistry	2 Apply principles of thermodynamics, kinetics, and equilibrium to organic reaction systems.
CHEM 12A	Organic Chemistry	3 Generate logical stepwise reaction mechanisms.

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CHEM 12A Organic Chemistry	4 Construct molecular structure from spectroscopic data.
CHEM 12B Organic Chemistry	1 Apply molecular orbital theory to predict the outcome of selected chemical reactions.
CHEM 12B Organic Chemistry	2 Apply resonance theory to predict the major and minor products of chemical reactions.
CHEM 12B Organic Chemistry	3 Generate logical multi-step syntheses of increasingly complex molecules.
CHEM 12B Organic Chemistry	4 Construct logical stepwise reaction mechanisms for increasingly complex chemical systems.
CHEM 12C Organic Chemistry	1 Apply the principles of thermodynamics, kinetics, equilibrium to biologically important molecules.
CHEM 12C Organic Chemistry	2 Conduct spectroscopic analysis and identify structures of biologically important molecules.
CHEM 12C Organic Chemistry	3 Generate stepwise reaction mechanisms of biologically important molecules.
CHEM 12C Organic Chemistry	4 Design logical syntheses and structural modifications of biologically important molecules.
CHEM 25 Preparation Course for General Chemistry	1 Assess the fundamental concepts of modern atomic and molecular theory.
CHEM 25 Preparation Course for General Chemistry	2 Evaluate the standard classes of chemical reactions.
CHEM 25 Preparation Course for General Chemistry	3 Demonstrate a fundamental understanding of mathematical concepts pertaining to chemical experimentation and calculations.
CHEM 30A Introduction to General, Organic and Biochemistry I	1 Solve stoichiometric problems by applying appropriate molar relationships.

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CHEM 30A Introduction to General, Organic and Biochemistry I	2 Identify the differences between elements and compounds and describe the chemical bonding in compounds- ionics vs. covalent.
CHEM 30B Introduction to General, Organic and Biochemistry II	1 Differentiate the general reactions of the principle organic functional groups.
CHEM 30B Introduction to General, Organic and Biochemistry II	2 Evaluate the major classes of biological compounds from a chemical perspective.
CHEM 77 Special Projects in Chemistry	1 Dependent on the nature of the project as determined in sections 3&4 of the Special Projects Contract.
ENGR 10 Introduction to Engineering	1 The student will be able to analyze, graph and develop a formula for a given data set.
ENGR 10 Introduction to Engineering	2 The student will be able to prepare and write technical specifications and documentation, and be able to orally present them.
ENGR 10 Introduction to Engineering	3 The student will work collaboratively on an engineering team.
ENGR 35 Statics	1 The student will be able to analyze two- and three-dimensional force systems on rigid bodies in static equilibrium using vector and scalar analysis methods.
ENGR 37 Introduction to Circuit Analysis	1 The student will be able to analyze circuits containing resistive, capacitive, inductive passive elements, along with op-amps interconnected to voltage and current sources.
ENGR 37 Introduction to Circuit Analysis	2 The student will be able to use circuit laws and network theorems to solve DC steady state circuits, RC, RL, and RLC DC circuit transients and sinusoidal AC steady state circuits.

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ENGR 77	Special Projects in Engineering	1 Investigate an area of special interest and demonstrate an appropriate level of understanding and expertise.
ENGR 78X	Special Projects in Electrical Engineering	1 Investigate an area of special interest in the fields of Electrical Engineering and demonstrate an appropriate level of understanding and expertise.
ENGR 79X	Special Projects in Mechanical Engineering	1 Investigate an area of special interest and demonstrate an appropriate level of understanding and expertise.
GEOL 10	Introductory Geology	1 Apply the principles of scientific methodology to evaluate hypotheses on how the earth works as an integrated system.
GEOL 10	Introductory Geology	2 Use data and observations to track and predict changes in the Earth system resulting from dynamic Earth Processes.
GEOL 10	Introductory Geology	3 Use observations from the crust and lithosphere of the Earth to determine geologic history at hand-sample, outcrop, local, and regional scales.
GEOL 10	Introductory Geology	4 Apply scientific methodology and geologic principles to analyze the impact of the Earth system on humanity, from specific natural hazards and the availability, use, and distribution of Earth resources.
GEOL 20	General Oceanography	1 Apply the principles of scientific methodology to test hypotheses as to how the Earth's oceans work as an integrated system.

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GEOL 20	General Oceanography	2 Use observations and data to characterize the dynamic Earth processes that act to shape the ocean floor and analyze the record of these processes within marine sediments and oceanic crust.
GEOL 20	General Oceanography	3 Analyze the dynamic movement of the water column of the oceans, through an application of the physical principles of ocean currents, waves, and tides and their effect on coastal systems and processes.
GEOL 20	General Oceanography	4 Apply scientific methodology and the principles of oceanography to analyze the impact of the ocean system on humanity, from specific natural hazards and the availability, use, and distribution of ocean resources.
MATH 1A	Calculus	1 Analyze and synthesize the concepts of limits, continuity, and differentiation from a graphical, numerical, analytical and verbal approach, using correct notation and mathematical precision.
MATH 1A	Calculus	2 Evaluate the behavior of graphs in the context of limits, continuity and differentiability.
MATH 1A	Calculus	3 Recognize, diagnose, and decide on the appropriate method for solving applied real world problems in optimization, related rates and numerical approximation.
MATH 1AH	Calculus - HONORS	1 Analyze and synthesize the concepts of limits, continuity, and differentiation from a graphical, numerical, analytical and verbal approach, using correct notation and mathematical precision.

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MATH 1AH Calculus - HONORS

2 Evaluate the behavior of graphs in the context of limits, continuity and differentiability.

MATH 1AH Calculus - HONORS

3 Recognize, diagnose, and decide on the appropriate method for solving applied real world problems in optimization, related rates and numerical approximation.

MATH 1B Calculus

1 Analyze the definite integral from a graphical, numerical, analytical, and verbal approach, using correct notation and mathematical precision.

MATH 1B Calculus

2 Formulate and use the Fundamental Theorem of Calculus.

MATH 1B Calculus

3 Apply the definite integral in solving problems in analytical geometry and the sciences.

MATH 1BH Calculus - HONORS

1 Analyze the definite integral from a graphical, numerical, analytical, and verbal approach, using correct notation and mathematical precision.

MATH 1BH Calculus - HONORS

2 Formulate and use the Fundamental Theorem of Calculus.

MATH 1BH Calculus - HONORS

3 Apply the definite integral in solving problems in analytical geometry and the sciences.

MATH 1C Calculus

1 Graphically, analytically, numerically and verbally analyze infinite sequences and series from the perspective of convergence, using correct notation and mathematical precision.

MATH 1C Calculus

2 Apply infinite sequences and series in approximating functions.

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MATH 1C Calculus

3 Synthesize and apply vectors, polar coordinate system and parametric representations in solving problems in analytic geometry, including motion in space.

MATH 1CH Calculus - HONORS

1 Graphically, analytically, numerically and verbally analyze infinite sequences and series from the perspective of convergence, using correct notation and mathematical precision.

MATH 1CH Calculus - HONORS

2 Apply infinite sequences and series in approximating functions.

MATH 1CH Calculus - HONORS

3 Synthesize and apply vectors, polar coordinate system and parametric representations in solving problems in analytic geometry, including motion in space.

MATH 1D Calculus

1 Graphically and analytically synthesize and apply multivariable and vector-valued functions and their derivatives, using correct notation and mathematical precision.

MATH 1D Calculus

2 Use double, triple and line integrals in applications, including Green's Theorem, Stokes' Theorem and Divergence Theorem.

MATH 1D Calculus

3 Synthesize the key concepts of differential, integral and multivariate calculus.

MATH 1DH Calculus - HONORS

1 Graphically and analytically synthesize and apply multivariable and vector-valued functions and their derivatives, using correct notation and mathematical precision.

## Physical Science/Math/Engineering

MATH 1DH Calculus - HONORS

2 Use double, triple and line integrals in applications, including Green's Theorem, Stokes' Theorem and Divergence Theorem.

MATH 1DH Calculus - HONORS

3 Synthesize the key concepts of differential, integral and multivariate calculus.

MATH 2A Differential Equations

1 Construct and evaluate differential equation models to solve application problems.

MATH 2A Differential Equations

2 Classify, solve and analyze differential equation problems by applying appropriate techniques and theory.

MATH 2B Linear Algebra

1 Construct and evaluate linear systems/models to solve application problems.

MATH 2B Linear Algebra

2 Solve problems by deciding upon and applying appropriate algorithms/concepts from linear algebra.

MATH 2B Linear Algebra

3 Apply theoretical principles of linear algebra to define properties of linear transformations, matrices and vector spaces.

MATH 10 Elementary Statistics and Probability

1 Organize, analyze, and utilize appropriate methods to draw conclusions based on sample data by constructing and/or evaluating tables, graphs, and numerical measures of characteristics of data.

MATH 10 Elementary Statistics and Probability

2 Identify, evaluate, interpret and describe data distributions through the study of sampling distributions and probability theory.

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MATH 10 Elementary Statistics and Probability

3 Collect data, interpret, compose and defend conjectures, and communicate the results of random data using statistical analyses such as interval and point estimates, hypothesis tests, and regression analysis.

MATH 10H Elementary Statistics and Probability - HONORS

1 Organize, analyze, and utilize appropriate methods to draw conclusions based on sample data by constructing and/or evaluating tables, graphs, and numerical measures of characteristics of data.

MATH 10H Elementary Statistics and Probability - HONORS

2 Identify, evaluate, interpret and describe data distributions through the study of sampling distributions and probability theory.

MATH 10H Elementary Statistics and Probability - HONORS

3 Collect data, interpret, compose and defend conjectures, and communicate the results of random data using statistical analyses such as interval and point estimates, hypothesis tests, and regression analysis.

MATH 11 Finite Mathematics

1 Identify, evaluate, and utilize appropriate linear and probability optimization models and communicate results.

MATH 11 Finite Mathematics

2 Compare, evaluate, judge, make informed decisions, and communicate results about various financial opportunities by applying the mathematical concepts and principles of the time value of money.

MATH 12 Introductory Calculus for Business and Social Science

1 Use correct notation and mathematical precision in the evaluation and interpretation of derivatives and integrals.

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MATH 12	Introductory Calculus for Business and Social Science	2 Evaluate, solve, interpret and communicate business and social science applications using appropriate differentiation and integration methodologies.
MATH 17	Integrated Statistics 2	1 Identify, evaluate, interpret and describe data distributions through the study of sampling distributions.
MATH 17	Integrated Statistics 2	2 Collect data, interpret, compose and defend conjectures, and communicate the results of random data using statistical analyses such as interval and point estimates, hypothesis tests, and regression analysis.
MATH 22	Discrete Mathematics	1 Critique a mathematical statement for its truth value, defend choice by formulating a mathematical proof or constructing a counterexample.
MATH 22	Discrete Mathematics	2 Analyze and apply patterns of discrete mathematical structures to demonstrate mathematical thinking.
MATH 23	Engineering Statistics	1 Organize, analyze, and utilize appropriate methods to draw conclusions based on sample data by constructing and/or evaluating tables, graphs, and numerical measures of characteristics of data.
MATH 23	Engineering Statistics	2 Use calculus based mathematics to construct, analyze, apply, and simulate probability and sampling distributions in theory and applications, and to justify appropriate statistical analyses and inferential methods.

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MATH 23	Engineering Statistics	3 Collect data, interpret, compose and defend conjectures, and communicate the results of random data using statistical analyses such as interval and point estimates, hypothesis tests, and regression analysis.
MATH 41	Precalculus I: Theory of Functions	1 Investigate, evaluate, and differentiate between algebraic and transcendental functions in their graphic, formulaic, and tabular representations.
MATH 41	Precalculus I: Theory of Functions	2 Synthesize, model, and communicate real-life applications and phenomena using algebraic and transcendental functions.
MATH 42	Precalculus II: Trigonometric Functions	1 Formulate, construct, and evaluate trigonometric models to analyze periodic phenomena, identities, and geometric applications.
MATH 43	Precalculus III: Advanced Topics	1 Analyze, investigate, and evaluate linear systems, vectors, and matrices related to two or three dimensional geometric objects.
MATH 43	Precalculus III: Advanced Topics	2 Graph and analyze regions/curves represented by inequalities or trigonometric, polar, and parametric equations, including conic sections.
MATH 43	Precalculus III: Advanced Topics	3 Analyze, develop, and evaluate formulas for sequences and series; Justify those formulas by mathematical induction.
MATH 44	Introduction to Contemporary Mathematics	1 Analyze contemporary mathematical problems, apply problem solving techniques using a variety of methods, and communicate the results mathematically through a variety of forms.

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MATH 44	Introduction to Contemporary Mathematics	2 Demonstrate and correctly apply basic mathematical techniques in at least five of the following ten areas: symmetry, graph theory, fractals and chaos theory, topology, number theory, geometry, combinatorics, methods of social choice, probability and statistics, economics and personal finance.
MATH 44	Introduction to Contemporary Mathematics	3 Examine and evaluate myths and realities about the contemporary discipline of mathematics and its practitioners.
MATH 46	Mathematics for Elementary Education	1 Analyze mathematical problems from elementary mathematics, apply problem solving techniques using a variety of methods, solve these problems individually and in groups, and communicate results mathematically through a variety of forms.
MATH 46	Mathematics for Elementary Education	2 Utilize ideas from number theory, distinguish types and properties of numbers, and employ mathematical rules for operating on rational and irrational numbers using verbal, symbolic, geometric, and numerical methods.
MATH 46	Mathematics for Elementary Education	3 Examine and evaluate myths and realities about the contemporary discipline of mathematics and its practitioners.
MATH 46	Mathematics for Elementary Education	4 Identify and discuss developments in the history of elementary mathematics from a variety of cultures.
MATH 76	Special Projects in Probability and Statistics	1 Investigate an area of special interest in the fields of probability and statistics and demonstrate an appropriate level of understanding and expertise.

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MATH 77 Special Projects in Mathematics	1 Investigate an area of special interest and demonstrate an appropriate level of understanding and expertise.
MATH 78 Special Projects in Pure Mathematics	1 Investigate an area of special interest in pure mathematics and demonstrate an appropriate level of understanding and expertise.
MATH 79 Special Projects in Applied Mathematics	1 Investigate an area of special interest in applied mathematics and demonstrate an appropriate level of understanding and expertise.
MATH 114 College Math Preparation Level 3: Intermediate Algebra	1 Evaluate real-world situations and distinguish between and apply exponential, logarithmic, rational, and discrete function models appropriately.
MATH 114 College Math Preparation Level 3: Intermediate Algebra	2 Analyze, interpret, and communicate results of exponential, logarithmic, rational, and discrete models in a logical manner from four points of view - visual, formula, numerical, and written.
MATH 201 Pre-Algebra Refresher	1 Place, via test at Placement Office, into a mathematics course above Math 210.
MATH 202 Beginning Algebra Refresher	1 Place, via test at Placement Office, into a mathematics course above Math 212.
MATH 203 Intermediate Algebra Refresher	1 Place, via test at Placement Office, into a mathematics course above Math 114.
MATH 210 College Math Preparation Level 1: Pre-Algebra	1 Demonstrate and apply a systematic and logical approach to solving arithmetic and geometric problems.
MATH 210 College Math Preparation Level 1: Pre-Algebra	2 Demonstrate and apply the knowledge and skills required to select the correct introductory formulas, procedures, and concepts from algebra and geometry and use them to solve problems.

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MATH 212 College Math Preparation Level 2: Beginning Algebra

1 Evaluate real-world situations and distinguish between and apply linear and quadratic function models appropriately.

MATH 212 College Math Preparation Level 2: Beginning Algebra

2 Analyze, interpret, and communicate results of linear and quadratic models in a logical manner from four points of view - visual, formula, numerical, and written.

MATH 212 College Math Preparation Level 2: Beginning Algebra

3 Demonstrate an appreciation and awareness of applications in their daily lives.

MATH 217 Integrated Statistics I

1 Organize, analyze, and utilize appropriate methods to draw conclusions based on sample data by constructing and/or evaluating tables, graphs, and numerical measures of characteristics of data.

MATH 217 Integrated Statistics I

2 Analyze and describe data distributions through the study of probability theory.

MATH 217 Integrated Statistics I

3 Evaluate real-world situations and apply linear, quadratic and exponential function models appropriately.

MATH 241 Academic Excellence in Precalculus I

1 Analyze and develop linear, polynomial, exponential, logarithmic and implicit function models.

MATH 241 Academic Excellence in Precalculus I

2 Communicate concepts and solutions for problems both verbally and in writing.

MATH 242 Academic Excellence in Trigonometry

1 Formulate, construct, and evaluate trigonometric models to analyze periodic phenomena, identities, and geometric applications.

MATH 242 Academic Excellence in Trigonometry

2 Communicate concepts and solutions for problems both verbally and in writing.

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MATH 243	Academic Excellence in Precalculus III	1 Analyze and develop trigonometric, matrix, and discrete models for problems within two- and three- dimensional Cartesian or polar coordinate systems.
MATH 243	Academic Excellence in Precalculus III	2 Communicate concepts and solutions for problems both verbally and in writing.
MET 10	Weather and Climate Processes	1 Analyze and explain the objective techniques used by synoptic meteorologists and climatologists to forecast our planet's weather and to predict future changes in our planet's climate. .
MET 10	Weather and Climate Processes	2 Assess and critique the impact of meteorology and climatology as sciences on local, national and international economic, environmental, ethical and political issues including climate change.
MET 10L	Meteorology Laboratory	1 Assess and defend the analysis and decision-making skills employed by meteorologists to diagnose air patterns, understand air motions and predict future atmospheric conditions.
MET 20L	Climate Studies Laboratory	1 To identify the primary reasons for studying Earth's climate system and how it functions and to become more aware of the significance of climate, climate variability and climate change for our well being wherever we live.
PHYS 2A	General Introductory Physics	1 Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of mechanics

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PHYS 2A General Introductory Physics

2 In order to test lab skills students are expected to gain confidence in taking precise and accurate scientific measurements, with their uncertainties, and then with calculations from them, analyze their meaning as relative, in an experimental context, to the verification and support of physics theories.

PHYS 2B General Introductory Physics

1 Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of electricity and magnetism.

PHYS 2B General Introductory Physics

2 In order to test lab skills students are expected to gain confidence in taking precise and accurate scientific measurements, with their uncertainties, and then with calculations from them, analyze their meaning as relative, in an experimental context, to the verification and support of physics theories.

PHYS 2C General Introductory Physics

1 Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of optics, thermodynamics, fluids, and modern physics.

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PHYS 2C	General Introductory Physics	2 In order to test lab skills students are expected to gain confidence in taking precise and accurate scientific measurements, with their uncertainties, and then with calculations from them, analyze their meaning as relative, in an experimental context, to the verification and support of physics theories.
PHYS 4A	Physics for Scientists and Engineers: Mechanics	1 Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of mechanics.
PHYS 4A	Physics for Scientists and Engineers: Mechanics	2 Gain confidence in taking precise and accurate scientific measurements, with their uncertainties, and then with calculations from them, analyze their meaning as relative, in an experimental context, to the verification and support of physics theories.
PHYS 4B	Physics for Scientists and Engineers: Electricity and Magnet	1 Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of electricity and magnetism.

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PHYS 4B	Physics for Scientists and Engineers: Electricity and Magnet	2 Gain confidence in taking precise and accurate scientific measurements, with their uncertainties, and then with calculations from them, analyze their meaning as relative, in an experimental context, to the verification and support of physics theories.
PHYS 4C	Physics for Scientists and Engineers: Fluids, Waves, Optics a	1 Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of waves, fluids, optics, and thermodynamics.
PHYS 4C	Physics for Scientists and Engineers: Fluids, Waves, Optics a	2 Gain confidence in taking precise and accurate scientific measurements, with their uncertainties, and then with calculations from them, analyze their meaning as relative, in an experimental context, to the verification and support of physics theories.
PHYS 4D	Physics for Scientists and Engineers: Modern Physics	1 Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of modern physics.
PHYS 4D	Physics for Scientists and Engineers: Modern Physics	2 Gain confidence in taking precise and accurate scientific measurements, with their uncertainties, and then with calculations from them, analyze their meaning as relative, in an experimental context, to the verification and support of physics theories.

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PHYS 10 Concepts of Physics

1 Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of physics in general.

PHYS 50 Preparatory Physics

1 Critically examine new, previously un-encountered problems, analyzing and evaluating their constituent parts, to construct and explain a logical solution utilizing, and based upon, the fundamental laws of mechanics.

PHYS 77 Special Projects in Physics

1 Investigate an area of special interest and demonstrate an appropriate level of understanding and expertise.