

DEPARTMENT OF MATHEMATICS AND PHYSICAL SCIENCES

Mission: The Mathematics program serves a vital role in equipping students for a Spirit-empowered life of Christ-centered leadership and service and is particularly aligned with the Vanguard Mission by its contribution to providing Christian Educators with a missionary outlook and a spiritual mandate to care for God's people through education. Moreover, the Department serves to enhance students' problem-solving capacities and capabilities as well as improving their mental calculations and reasoning skills – all processes which eventually lead to lifelong success. Students are, therefore, prepared for careers in elementary or secondary education, for graduate studies in mathematics, or a career in applied mathematics. The department also provides background courses in mathematics necessary for other areas of study such as physics, chemistry, biology, or kinesiology. This subject matter preparation program is approved by the California Commission on Teacher Credentialing (CTC).

All majors in Natural and Physical Sciences are expected to make satisfactory academic progress toward graduation. In addition to the requirements established by the University, students must maintain a 2.0 in all major coursework. Further, the Department also requires a minimum grade of C- as completion for pre-requisites in science-related coursework for all students enrolled in MATH, BIOL, ENVR, CHEM, and PSCI courses, regardless of major.

Mathematics Placement Exam

Courses in the Department of Mathematics at any institution are demanding, and Vanguard University is no exception. To help you prepare for college-level mathematics at Vanguard, the Department of Mathematics requires the **placement** of all incoming students who want to take math (either MATH-116 College Algebra, MATH-170C Precalculus or MATH-180C Calculus 1), regardless of major. The Placement Exam is managed through a third party entity, called ALEKS Placement, Preparation and Learning (ALEKS PPL) which offers colleges and universities a complete solution for math placement and course preparedness. Combining a research-based, accurate placement assessment with personalized learning tools to help students refresh lost knowledge gives them the opportunity to succeed before they even begin class.

VISTA: Mathematics Education Emphasis Minor Courses

The Vanguard Integrated STEM Teacher Achievement Program (VISTA) is one of several Integrated Teaching Education Programs (ITEP) offered at Vanguard. The ITEP programs allows for students to complete not only their bachelor's degree but also the California Teaching Credential within four years. This is a great option for students preparing to teach mathematics at the secondary school level. The Bachelor of Science in Mathematics degree with this option is approved by the California Commission on Teacher Credentialing. Completion of this option will satisfy the subject matter requirement for the Single Subject Teaching Credential in Mathematics within four years. Students wishing to graduate on a four year plan are still eligible to enroll in the fifth year credential program at Vanguard University or some other

accredited college or university to complete subject requirements for the California Clear Teaching Credential in Mathematics (see the Graduate Program in Education for these requirements). Students completing this option must include MATH-315 Teaching/Tutoring, MATH-330 Number Theory, MATH-380 Elementary Analysis I, MATH-410 Abstract Algebra and MATH-420 Higher Geometry as a part of their degree program. They should also take ENGL-453 Language, Culture, and Linguistics and POLS-155C American Democracy (see program requirements).

Program Learning Outcomes

[[Need Program Learning Outcomes for Departments]]

Program Majors:

There are four possible degrees in Mathematics including: *Actuarial Science*, *Data Science*, *Mathematics*, and *Mathematics Teaching with an Education Minor* (the VISTA program). All four programs have a common core of foundational mathematics courses with additional specific courses that provide the academic expertise in the respective sub-discipline.

- Actuarial Science B.S. (<https://catalog.vanguard.edu/stem/undergraduate/mathematics-physical-sciences/actuarial-science-bs/>)
- Computer Science B.S. (<https://catalog.vanguard.edu/stem/undergraduate/mathematics-physical-sciences/computer-science-bs/>)
- Data Science B.S. (<https://catalog.vanguard.edu/stem/undergraduate/mathematics-physical-sciences/data-science-bs/>)
- Engineering Physics (B.S.) (<https://catalog.vanguard.edu/stem/undergraduate/mathematics-physical-sciences/engineering-physics-bs/>)
- Mathematics B.S. (<https://catalog.vanguard.edu/stem/undergraduate/mathematics-physical-sciences/mathematics-bs/>)
- Mathematics B.S. with an Education Minor (VISTA) (<https://catalog.vanguard.edu/stem/undergraduate/mathematics-physical-sciences/mathematics-bs-education-minor/>)

Minors:

- Mathematics Minor (<https://catalog.vanguard.edu/stem/undergraduate/mathematics-physical-sciences/mathematics-minor/>)

California Teaching Credential:

- Mathematics Teaching Credential (<https://catalog.vanguard.edu/stem/undergraduate/mathematics-physical-sciences/mathematics-teaching-credential/>)



Courses

Computer Sciences

CSCI-100C Introduction to Computer Science 3 Credits

Introductory course in computer science and the study of algorithms appropriate for students in data-intensive disciplines. Topics include how computers work, simple algorithms and their efficiency, networking, databases, artificial intelligence, graphics, simulation and modeling, security and the social impact of computing. Includes a choice of five programming language modules. The course also includes a gentle hands-on introduction to programming concepts with Python.

Co-Requisite: CSCI-100CL

Terms Typically Offered: Fall.

CSCI-100CL Introduction to Computer Science Lab 1 Credit

Introductory course in computer science and the study of algorithms appropriate for students in data-intensive disciplines. Topics include how computers work, simple algorithms and their efficiency, networking, databases, artificial intelligence, graphics, simulation and modeling, security and the social impact of computing. Includes a choice of five programming language modules. Students will gain a solid background in computing hardware and software networks, programming languages, and applications.

Co-Requisite: Must take CSCI-100C at same time.

Terms Typically Offered: Fall.

CSCI-205 Cybersecurity 3 Credits

This course will provide a basic introduction to of all aspects of cybersecurity including business, policy and procedures, communications security, network security, security management, legal issues, political issues, and technical issues. This serves as the introduction to the cyber security track in electrical and computer engineering department.

Terms Typically Offered: Spring.

CSCI-208 JavaScript 3 Credits

This course provides the beginning programmer with a guide to developing applications using Java script. Java script is popular among professional programmers because it can be used to build visually interesting graphical user interface (GUI) and Web- based applications. Java script also provides an excellent environment for the beginning programmer-a student can quickly build useful programs while learning the basics of structured and objectoriented programming techniques.

Terms Typically Offered: Spring.

CSCI-309 Network Security and Digital Crime 3 Credits

This course provides an introduction to the methodology and procedures associated with digital forensic analysis in a network environment. Students will develop an understanding of the fundamentals associated with the topologies, protocols, and applications required to conduct forensic analysis in a network environment. Students will learn about the importance of network forensic principles, legal considerations, digital evidence controls, and documentation of forensic procedures.

This course will incorporate demonstrations and laboratory exercises to reinforce practical applications of course instruction and will require an independent research paper related to the course topic.

Terms Typically Offered: Spring.

CSCI-317 Algorithms and Data Structure 3 Credits

Recommended MATH-375. Algorithms are recipes for solving computational problems. This course provides an introduction to mathematical modeling of computational problems. It covers the common algorithms, algorithmic paradigms, and data structures used to solve these problems. The course emphasizes the relationship between algorithms and programming and introduces basic performance measures and analysis techniques for these problems.

Terms Typically Offered: Spring.

CSCI-320 Digital Forensics and Investigation 3 Credits

This course is an overview of the principles and practices of digital investigation. Fundamentals and the importance of digital forensics is emphasized. Students learn different techniques and procedures that enable them to perform a digital investigation with a primary focus on the analysis of physical storage media and volume analysis. It covers the major phases of digital investigation such as preservation, analysis and acquisition of artifacts that reside in hard disks and random-access memory. Upon completion of the course, students will be able to apply open-source forensics tools to perform digital investigations and understand the underlying theory behind these tools.

Terms Typically Offered: Spring.

CSCI-325 Introduction to Networks 3 Credits

An introduction to the design and analysis of computer communication networks. Topics include application layer protocols, Internet protocols, network interfaces, local and wide area networks, wireless networks, bridging and routing, and current topics. Lecture.

Terms Typically Offered: Spring.

CSCI-325L Introduction to Networks 1 Credit

This lab course reinforces some of the networking concepts that are taught in any introductory networking course. The lab is structured around exercises that highlight topics such as addressing, subnetting, bridging, ARP, routing (RIP, OSPF), TCP, ICMP, NAT, DHCP, DNS, etc. Students are required to review introductory networking material for each lab. Lab Fee.

Terms Typically Offered: Spring.

CSCI-330 Operating Systems 3 Credits

This course will introduce modern operating systems. The course will begin with an overview of the structure of modern operating systems. And then will analyze in detail each of the major components of an operating system (from processes to threads), and explore more advanced topics in the field, including memory management and file input/output. Covers the classical internal algorithms and structures of operating systems, including CPU scheduling, memory management, and device management. Considers the unifying concept of the operating system as a collection of cooperating sequential processes. Covers topics including file systems, virtual memory, disk request scheduling, concurrent processes, deadlocks, security, and integrity. The focus is on UNIX-based operating systems, though learning will also cover alternative operating systems, including Windows. Lecture, 3 hours. A complementary lab course allows students to practice and implement topics from lecture.

Terms Typically Offered: Fall.



CSCI-330L Operating Systems Laboratory 1 Credit

Experimentally based laboratory that is complementary to the lecture. Introduction to the internals of operating systems; designing and implementing components within commercial operating systems: system calls, CPU scheduling, context switching, process management, memory management, file systems. Lab Fee.

Terms Typically Offered: Fall.

CSCI-333 Web and Mobile App Development 3 Credits

Mobile computing devices have become ubiquitous in our communities. In this course, focus is on the creation of mobile solutions for various modern platforms, including major mobile operating systems. HTML5, CSS and JavaScript are used to develop mobile web apps for smart phones and tablet/pad devices. Topics include CSS media queries, mobile user interfaces, platform-independent development, and best practices. Also covers geolocation, maps, audio, video, drawing, animation and offline apps. Provides an introduction to open-source mobile development frameworks, emulators, conversion to native apps, performance and testing. Intended for students with previous programming experience.

Terms Typically Offered: Spring.

CSCI-340 Python Programming 3 Credits

Introduction to programming basics (what it is and how it works), binary computation, problem-solving methods and algorithm development. Includes procedural and data abstractions, program design, debugging, testing, and documentation. Covers data types, control structures, functions, parameter passing, library functions, arrays, inheritance and objectoriented design. Lecture Lab Combination. Laboratory exercises in Python.

Terms Typically Offered: Fall.

CSCI-400 Data Visualization 3 Credits

Visualization is increasingly important in this era where the use of data is growing in many different fields. Data visualization techniques allow people to use their perception to better understand this data. The goal of this course is to introduce students to data visualization including both the principles and techniques. Students will learn the value of visualization, specific techniques in information visualization and scientific visualization, and understand how to best leverage visualization methods.

CSCI-415 Computer Architecture 3 Credits

Modern computer technology requires an understanding of both hardware and software, since the interaction between the two offers a framework for mastering the fundamentals of computing. The purpose of this course is to cultivate an understanding of modern computing technology through an in-depth study of the interface between hardware and software. An overview of computer architecture, which stresses the underlying design principles and the impact of these principles on computer performance will be surveyed. General topics include design methodology, processor design, control design, memory organization, system organization, and parallel processing. Lecture, 3 hours. A complementary lab course allows students to practice and implement topics from lecture.

Terms Typically Offered: Fall.

CSCI-415L Computer Architecture 1 Credit

This is the laboratory class associated with CSCI-415 Introduction to Computer Architecture. Over the course of the quarter, you will design a processor that implements an instruction set of your own design. It provides the chance to grapple first-hand with the issues of processor design. Lab fee.

Terms Typically Offered: Fall.

CSCI-425 Computing Theory 3 Credits

The goal of this course is to understand the fundamental limits on what can be efficiently computed in our universe and other possible universes. These limits reveal deep and mysterious properties about information, knowledge, and processing, as well as practical issues about what can and cannot be computed. The course introduces the foundations of automata theory, computability theory, and complexity theory. Shows relationship between automata and formal languages. Addresses the issue of which problems can be solved by computational means (decidability vs undecidability), and Introduces concepts related to computational complexity of problems. Lecture, 3 hours.

Terms Typically Offered: Spring.

CSCI-430 Cryptology 3 Credits

The objective of this course is to provide a foundation of cryptography in an applied manner so that students can grasp its importance in relation to the rest of information security. The course covers principles of number theory and cryptographic algorithms and cryptanalysis. Topics include: steganography, block and stream ciphers, secret key encryption (DES, AES, RC-n), primes, random numbers, factoring, and discrete logarithms; Public key encryption (RSA, Diffie-Hellman, Elliptic curve cryptography); Key management, hash functions, digital signatures, certificates and authentication protocols. Cryptanalytic methods (known, chosen plaintext etc.) for secret and public key schemes (linear and differential cryptanalysis, Pollard's rho method, number field sieve, etc.)

Terms Typically Offered: Spring.

CSCI-450 UG Research or Internship Program 1-4 Credits

This course may be taken for a maximum of four (4) units in one semester. A maximum of six (6) combined units credit for CSCI-450 or CSCI-485 apply to graduation. This course is designed with the purpose of providing students the opportunity to conduct research off-campus at universities or STEM companies in the community. This course promotes early entry into the workplace for the student through part-time employment. This course requires actual work experience be sought in a biotech or STEM-focused business firm providing an opportunity to integrate classroom teaching in practical application under the direct supervision of the assigned instructor. Students are responsible for completing a project report and presenting their research results in CSCI-499C.

Terms Typically Offered: Summer.

CSCI-485 Undergraduate Computer Science Research 1-4 Credits

This course provides the student with an empirically-based research experience in the computer sciences. Emphasis will be placed on project management, safety, instrumentation, software development, and research documentation skills. This course is a variable credit course. Two units are recommended for all computer science majors. It is expected that a research report be completed at the conclusion of the research project and an oral presentation of the results be given in CSCI-499C. This course may be repeated for credit. Lab fee.



CSCI-488 Computer Science Sr. Project 2 Credits

An advanced course providing the opportunity for a student to create a novel and independent intellectual work by comparing, contrasting and synthesizing recent research and his/her cumulative knowledge and understanding in the computer sciences. The precise nature, scope and format of the project must be developed and approved under the guidance of the instructor and in collaboration with the student's academic advisor. Senior projects are typically initiated in the Fall. The project results must also be presented in CSCI-499C.

CSCI-499C Capstone Seminar in Computer Science 2 Credits

This course includes analysis and evaluation of current research in computer sciences and the integration of faith and learning in the computer and physical sciences. An oral presentation of CSCI-488 is required. In-class presentations by faculty and guests are a part of the course. This course fulfills the Core Curriculum Capstone requirement for Computer Science majors.

Data Sciences

DSCI-100C Introduction to Data Science 3 Credits

This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Students will learn the concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling, data product creation, evaluation and effective communication. The focus in the treatment of these topics will be on breadth, rather than depth, and emphasis will be placed on integration and synthesis of concepts and their application to solving problems. To make the learning contextual, real datasets from a variety of disciplines will be used.

Terms Typically Offered: Fall.

DSCI-100CL Introduction to Data Science Laboratory 1 Credit

Co-Requisite: DSCI-100C This course will introduce students to this rapidly growing field and equip them with some of its basic principles and tools as well as its general mindset. Students will learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling, data product creation, evaluation, and effective communication. The focus in the treatment of these topics will be on breadth, rather than depth, and emphasis will be placed on integration and synthesis of concepts and their application to solving problems. To make the learning contextual, real datasets from a variety of disciplines will be used.

Terms Typically Offered: Fall.

DSCI-300 Database Management 3 Credits

Developing and managing efficient and effective database applications requires understanding the fundamentals of database management systems, techniques for the design of databases, and principles of database administration. This course emphasizes database concepts, developments, use and management in three main sections: database concepts, practice, and emerging trends. Relational database systems are the main focus, but other types, including object-oriented databases, are studied. Practical design of databases and developing database applications using modern software tools will be emphasized.

DSCI-350 Data Mining 3 Credits

Data Mining studies algorithms and computational paradigms that allow computers to find patterns and regularities in databases, perform prediction and forecasting, and generally improve their performance through interaction with data. It is currently regarded as the key element of a more general process called Knowledge Discovery that deals with extracting useful knowledge from raw data. The knowledge discovery process includes data selection, cleaning, coding, using different statistical and machine learning techniques, and visualization of the generated structures. The course will cover all these issues and will illustrate the whole process by examples. Special emphasis will be given to the Machine Learning methods as they provide the real knowledge discovery tools. Important related technologies such as data warehousing and online analytical processing (OLAP), will be also discussed. The students will use recent Data Mining software.

Terms Typically Offered: Fall.

DSCI-403 Bus Analytics and Professional Comm 3 Credits**DSCI-410 Data Visualization 3 Credits**

Visualization is increasingly important in this era where the use of data is growing in many different fields. Data visualization techniques allow people to use their perception to better understand this data. The goal of this course is to introduce students to data visualization including both the principles and techniques. Students will learn the value of visualization, specific techniques in information visualization and scientific visualization, and understand how best to leverage visualization methods.

Prerequisite: DSCI-300

Terms Typically Offered: Fall, even years.

DSCI-415 Experimental Design, Stat Analysis/Progm 3 Credits

Introduces advanced statistical concepts and analytical methods for the experimental needs and data encountered in computer, data and physical sciences. Experimental design/conduct, quantitative analysis of data, and statistical inferences and interpretations are studied for scientific hypothesis testing, as well as clinical trials. Explores methodological approaches to bioassay development/testing and provides a foundation for critically evaluating information to support research findings, product claims, and technology opportunities. Students apply statistical analysis software and write algorithms in programming languages commonly used in technology and professional science industries (ie. Python). Topics include statistical tools such as Bayesian statistics, Markov processes, and information theoretic indices.

DSCI-450 UG Research or Internship Program 1-4 Credits

Terms Typically Offered: Summer.

DSCI-485 Undergrad Biological Research 1-4 Credits**DSCI-499C Capstone Seminar in DSCI 2 Credits**

Engineering Physics

ENGR-310 Electronics I 4 Credits

An introduction to the theory and application of electronic (analog and digital) circuits and devices. The course focuses on the analysis and building of simple electronic circuits. Topics covered include: steady state circuit analysis using complex numbers, simple time-domain analysis and circuit simulation software, semiconductor physics, junctions and transistors, amplifiers, feedback, control circuits, filters, oscillators, optoelectronic devices, electronic noise and signal to noise improvement, field effect transistors, logic gates, digital electronics, signal processing and hybrid analog/digital circuits, and AM/FM and high frequency circuits. This course will be taught in a workshop format which combines laboratory and lecture in the same session.

Terms Typically Offered: Spring, even years.

ENGR-310L Electronics I Lab 1 Credit

This course supports the ENGR-310 lecture, which will be taught in a workshop type format that combines laboratory and lecture in the same session.

Terms Typically Offered: Spring, even years.

ENGR-320 Optics 4 Credits

This is an introductory Optics course with emphasis on applying lectured, theoretical principles in a hands-on setting. This course will cover the fundamental properties of light propagation and interaction with matter under the approximations of geometrical optics and scalar wave optics. In particular, topics in geometrical optics will include: ray-tracing, aberrations, lens design, apertures and stops, radiometry and photometry. Topics covered in wave optics include: basic electrodynamics, polarization, interference, wave-guiding, Fresnel and Fraunhofer diffraction, image formation, resolution. The course will be taught in a workshop format which combines laboratory and lecture in the same session.

Terms Typically Offered: Fall, even years.

ENGR-320L Optics Laboratory 1 Credit

This course supports the ENGR-320 lecture, which will be taught in a workshop type format that combines laboratory and lecture in the same session.

Terms Typically Offered: Fall, even years.

ENGR-400 Introduction to Materials Science Engr. 3 Credits

This course is designed to introduce the students to basic materials science and engineering and applications of this field in emerging technologies. Topics include: . Atomic structure, chemical bonding, crystal structure, defects, diffusion, phase diagrams, mechanical and magnetic properties, thermal, electrical and optical behavior . Correlation of the mechanical, electrical and optical properties of different material systems such as metals and alloys, ceramics, polymers to the microstructure of the material. . How material properties are influenced by thermal and mechanical treatments . Strengthening mechanisms in materials. . The effects of the environment on materials and the possible failure modes of structures. . Application of material systems in photonics, microelectronics, and other technology fields. . Design limitation for metal alloys, ceramics, semiconductors and polymers . Application of materials design concepts to selecting the material most suitable for a given application. Students will need to have prior basic knowledge of chemistry and physics. Lecture three hours.

Terms Typically Offered: Spring, even years.

ENGR-400L Intro/Materials Science Laboratory 1 Credit

This laboratory course supports the ENGR-400 lecture.

Terms Typically Offered: Spring, even years.

Mathematics

MATH-104 Math for Liberal Arts 3 Credits

A non-technical course emphasizing the ideas and concepts of mathematics. Algebra, number theory, set theory, geometry, statistics, probability, and analysis of the ideas and methods involved.

MATH-105 Essential Mathematics 4 Credits

This course prepares students to understand the essential mathematical concepts in number sense, elementary algebra, sets of numbers, problem solving, ratios, proportions, percentages, and graphing linear equations and inequalities. The course is designed to introduce students to practical mathematical skills necessary for courses in business and statistics. Emphasis will be placed on the structural and logical foundations of business. (Meets Elective requirement only; not applicable to Natural Science/Math requirement)

MATH-106 Business Math 4 Credits

This course applies the principles and practices of mathematics to everyday business problems and situations. The course prepares students to understand the mathematical and business concepts in problem solving, ratios and proportions, percentages, simple and compound interest, graphing linear functions, and inventory valuation. The course introduces students to common mathematical skills necessary for courses in business. (Meets Natural Science/Math requirement)

MATH-109 Mathematics for Statistics 4 Credits

This course prepares students to understand the mathematical and statistical concepts in problem solving, critical thinking, ratios and proportions, algebraic equations, sets and logic, probability and statistics, including frequency of distribution, statistical graphs, measures of central tendency, and measure of position and dispersion. The course introduces students to common mathematical skills necessary for coursework in statistics. (Meets Natural Science/Math requirement)

MATH-115C Applied Mathematics and Personal Finance 3 Credits

This course introduces the use of mathematics as a logically thinking and problem-solving tool of practical applications, emphasizing inductive and deductive reasoning, graphs, tables, percentage as it applies to loans, mortgages, credit cards, etc., probability, statistics, and the use and misuse of numbers. Applications include variables, conditionals, and statistical functions. Students majoring in Mathematics are exempt from taking the core curriculum requirement in mathematics.

MATH-116 College Algebra 3 Credits

Sets and real numbers, linear equations and inequalities, polynomials, functions, graphing linear and polynomial functions, exponential and logarithmic functions, systems of equations, matrices and determinants, sequences and series.

MATH-116C College Algebra 3 Credits

Sets and real numbers, linear equations and inequalities, polynomials, functions, graphing linear and polynomial functions, exponential and logarithmic functions, systems of equations, matrices and determinants, sequences and series. Fulfills the Math CORE requirement.

MATH-117 College Trigonometry 3 Credits

Complex numbers, trigonometric functions and applications.



MATH-120 Math for Elementary Teachers 3 Credits

Introductory set theory, problem solving, basic algorithms, elementary number theory, geometry and coordinate geometry. Emphasis will be on the structural and logical foundations of mathematics.

Prerequisite: Take MATH-145C MATH-170C or MATH-180C;

MATH-145C Data Analysis 3 Credits

This course introduces the use of mathematics as a thinking and problem-solving tool, emphasizing data interpretation, graphs, tables, statistical arguments, probability, statistics, and the use and misuse of numbers. Spreadsheet applications include variables, conditionals, and statistical functions. Students majoring in Mathematics are exempt from taking the core curriculum requirement in mathematics.

MATH-170C Precalculus 3 Credits

Equations and inequalities; systems of linear equations: functions, graphs, exponential, logarithmic, and trigonometric functions and their limits; polynomial and rational functions; analytic geometry. This course fulfills the Math CORE requirement.

MATH-180C Calculus 1 4 Credits

Graphing of functions, logarithmic functions and their inverses; limit of functions and derivatives; rules of differentiation and their application; definite and indefinite integrals. Fulfills Math CORE requirement.

Prerequisite: MUST COMPLETE: MATH-170c

MATH-181C Calculus II 4 Credits

PREREQUISITE: MATH-180 or Consent of the Instructor. Application of integration for volumes, work and areas; advanced techniques of integration; advanced application of integration; first order differential equations; parametric equations and polar coordinates; infinite sequences and series.

Prerequisite: Must take MATH-180 or have consent of the instructor

MATH-207 Computer Programming 3 Credits

Open to all majors, this course offers the basic concepts of programming, problem solving, programming logic, as well as the design techniques.

Programming language is chosen from languages such as Visual Basic, C++ and MatLab. Special fee for computer lab use.

MATH-210 Technical Writing 3 Credits

Expository writing on technical subjects dealt with in industry, science, and education. Long and short forms including reports, proposals, journal articles, and research papers.

MATH-235 Statistics for Health Professionals 3 Credits

Limited to those enrolled in Health Sciences. Meets statistics prerequisite for NURS 405. This course introduces the conceptual background of statistical techniques and reasoning with an emphasis on application relevant to identifying outcomes. Provides a framework for understanding and applying commonly used data analysis techniques in health science research. Includes selecting, applying, and interpreting univariate and bivariate statistical methods in answering research questions from a health science perspective.

MATH-265C Intro to Statistical Methods 3 Credits

This course is cross listed with PSYC-265C and SOC-265C. A course in basic statistical concepts and methods of collecting, summarizing, presenting, and interpreting data in the behavioral sciences; including descriptive statistics (use of graphs and charts), normal distribution curve, measures of central tendency, deviation and dispersion, hypothesis testing, statistical fallacies, correlation, and topics in probability. Students majoring in Accounting, Anthropology, Psychology, or Sociology must take MATH-265C, PSYC-265C, or SOC-265C to fulfill the core curriculum requirement in mathematics. Students majoring in Mathematics are exempt from taking the core curriculum requirement in mathematics.

MATH-270C Health Professions Statistical Methods 3 Credits

The focus of this course is on exploring the statistical methods used in health professions. Students review parametric and nonparametric techniques and explore the purpose, assumptions, selection, and interpretation of descriptive and inferential statistics. As part of the course, students use Microsoft Excel to organize and analyze data sets. Open to all undergraduate health science students.

MATH-281 Multivariable Calculus 4 Credits

Vectors and geometry of space including cylindrical and spherical coordinates; vector functions and space curves with vector calculus, partial derivatives with directional derivatives and applications; multiple integrals with various coordinate systems with application; and second-order differential equations.

Prerequisite: MATH-181 or MATH-181C

MATH-285 Intro to Adv Mathematics 3 Credits

A course for both mathematics and mathematics education majors. Covers the fundamentals of axiomatic proof theory including laws of inference, set theory, induction, cardinality, relations and functions.

MATH-291 Special Topic: 1 Credit

Study of a special topic in mathematics. May be repeated for credit.

MATH-292 Special Topic: 2 Credits

Study of a special topic in mathematics. May be repeated for credit.

MATH-293 Special Topic: 3 Credits

Study of a special topic in mathematics. May be repeated for credit.

MATH-294 Sp Top: Into to Comp Science 4 Credits

Study of a special topic in mathematics. May be repeated for credit.

MATH-300 Linear Algebra 3 Credits

Systems of linear equations, vector spaces, linear mappings, matrices and matrix algebra, eigenvectors and eigenvalues, Cayley-Hamilton theorem, quadratic forms, and applications.

Prerequisite: MATH-285

MATH-310 Differential Equations 3 Credits

Methods of solution of ordinary differential equations and applications.

MATH-315 Teaching/Tutoring 3 Credits

This course is designed to give the student introductory experiences in both tutoring and planning classroom observations. These early field experiences will link together mathematical content along with classroom management and interaction with students from diverse populations represented in the California public schools. Lab fee.

MATH-330 Number Theory 3 Credits

Divisibility properties of integers, prime numbers, the Euclidean algorithm, the unique factorization theorem, congruences, Fermat's theorem, Wilson's theorem, Diophantine equations, number-theoretic functions, and the quadratic reciprocity theorem.

MATH-365 Probability and Statistics 3 Credits

Frequency interpretation of probability, axioms of probability theory, discrete probability and combinatorics, random variables, distribution and density functions, sampling theory and limit theorems.

MATH-370 History of Mathematics 3 Credits

An introduction to the history of mathematics from ancient times to the twentieth century, with applications to elementary mathematics through calculus.

MATH-375 Discrete Mathematics 3 Credits

This course is designed to study graph theory including networks, voting systems including game theory and fair apportionment, and patterns.

Prerequisite: MATH-181 or MATH-181C, MATH-285

MATH-380 Elementary Analysis I 3 Credits

Rigorous analysis of the calculus and its foundations. Continuous and differentiable functions, and topological properties of the real number line.

MATH-390 Numerical Analysis 3 Credits

Numerical solution of algebraic equations. Approximate numerical solutions of systems of linear and nonlinear equations, interpolation theory, numerical differentiation and integration, and numerical solution of ordinary differential equations.

Prerequisite: MATH-281 or equivalent

MATH-400 Casualty & Actuarial Mathematics 3 Credits

The course covers concepts from calculus and probability as they pertain to actuarial sciences. The calculus part covers limits of functions, derivative and integration and their applications, power series and polar coordinates, multivariate differentiation and integration. The probability part covers basic concepts of probability, conditional probability and Bayes' theorem, discrete and continuous random variables and distributions, bivariate distributions, conditional expectation and variance, transformations of random variables and moment generating function. The pace will be fast and the stress will be on the SOA/CAS Course 1 exam-type of word problems.

MATH-410 Abstract Algebra 3 Credits

An introduction to modern ideas of algebra, set theory, groups, rings, and fields.

Pre- or Co-Requisite: MATH-300 or MATH-310

MATH-420 Higher Geometry 3 Credits

Euclidean geometry from an advanced standpoint, and topics in non-Euclidean geometry.

MATH-450 UG Research and Internship Program 1-4 Credits

Prerequisite: Open to juniors and seniors. This course may be taken for a maximum of 4 units in one semester. A maximum of 6 combined units credit for MATH-450 or MATH-485 apply to graduation. This course is designed with the purpose of providing students the opportunity to conduct research off-campus at universities or STEM companies in the community. This course promotes early entry into the workplace for the student through part-time employment. This course requires actual work experience be sought in a biotech or STEM-focused business firm providing an opportunity to integrate classroom teaching in practical application under the direct supervision of the assigned instructor.

Students are responsible for completing a project report and presenting their research results in MATH-499C

Terms Typically Offered: Summer.

MATH-455 Mathematics Teaching Internship 1-3 Credits

Must have the consent of the instructor and department chair. Regular hours each week for classes and/or meetings are established at the beginning of the semester with the supervising instructor. The intern assists an instructor in planning and conducting a course and/or laboratory session. This course may be taken for 1-3 units per semester. May be repeated for a maximum of six units.

MATH-470 Special Topic: 1-3 Credits

Study in a special topic in mathematics. May be repeated for credit.

MATH-480 Individual Studies: 1-3 Credits

May be repeated for credit.

MATH-485 Undergraduate Research 2 Credits

This course provides the student with an empirically-based research experience in the mathematical, biological, or chemical sciences. This course is structured around addressing problems in advanced laboratory research with emphasis on research techniques including: project management, safety, instrumentation, computer programming, and notebook documentation. Research is carried out under the supervision of the instructor with weekly conferences to discuss results and direction. A written proposal and report emphasizing the literature background of the problem and the experimental results are required. The results of the research project will also be presented in an oral format in MATH-499C, BIOL-499C, CHEM-499C. This course is a variable credit course. At least two units are recommended for all mathematics, environmental sciences, and biology majors and are required for all chemistry, engineering physics, and biochemistry majors. A minimum of 50 hours of laboratory work is required per unit. May be repeated. Lab fee. Terms Typically Offered: Summer.

MATH-488 Senior Project 2 Credits

An advance course providing the opportunity for a student to create a novel and independent intellectual work by comparing, contrasting and synthesizing recent research and his/her cumulative knowledge and understanding in the biological sciences. The precise nature, scope and format of the project must be developed and approved under the guidance of the instructor and in collaboration with the student's academic advisor. Senior projects are typically initiated in the Fall. The project results must also be presented in MATH-499C.

Prerequisite: MATH-285

Terms Typically Offered: Summer.



MATH-499C Mathematics Capstone 2 Credits

This course includes analysis and evaluation of current research in STEM and the integration of faith and learning in the mathematical sciences. An oral presentation of MATH-485 or MATH-488 is required. In-class presentations by faculty and guests are a part of the course. Attendance of both on-campus and off-campus seminars are required. This course fulfills the Core Curriculum Capstone requirement for Mathematics majors.

Physical Sciences

PSCI-130 Introduction to Physics I 3 Credits**PSCI-130C General Physics I 3 Credits**

This is a trigonometry based course in mechanics and heat. Topics include kinematics, Newton's Laws, rotational motion, fluid mechanics, and laws of thermodynamics. Three hours of lecture. This course fulfills the core curriculum lecture requirement in natural sciences.

Co-Requisite: PSCI-130CL

PSCI-130CL General Physics I Lab 1 Credit

Laboratory experiments will demonstrate principles studied during lecture sessions. These experiments demonstrate principles in the areas of rotational motion, momentum, fluid mechanics, heat transfer, friction and conservation of mechanical energy. This course fulfills the core curriculum laboratory requirement in the natural sciences. Laboratory three hours. Lab fee.

Prerequisite: MATH-116C, MATH-117, MATH-170C or MATH-180C

Co-Requisite: PSCI-130C

PSCI-131 General Physics II 3 Credits

This is a trigonometry based course in electricity, magnetism, sound and light. Topics include mechanical waves, sound, Coulomb's Law, electrostatics, electric circuits, introductory electronics, magnetic fields, induction, wave mechanics, geometrical optics, interference, diffraction and polarization. Three hours of lecture. This course fulfills the core curriculum lecture requirement in natural science.

Prerequisite: PSCI-130C

Co-Requisite: PSCI-131L

PSCI-131L General Physics II Lab 1 Credit

Laboratory experiments will demonstrate principles studied during lecture sessions. These experiments demonstrate principles in the areas of electrical current, electrical potential, electrical circuits, magnetic fields, optics, wave motion, and optics. This course fulfills the core curriculum laboratory requirement in the natural sciences. Laboratory three hours. Lab fee.

Prerequisite: PSCI-130CL

Co-Requisite: PSCI-131

PSCI-215 Fundamentals of Earth Science 4 Credits

Earth science including physical and historical geology, meteorology, and descriptive astronomy; the economic, social, and philosophical aspects of the subject matter. Lab fee. (meets Natural Science/Math requirement)

PSCI-215C Fundamentals of Earth Science 3 Credits

Earth Science including physical and historical geology, oceanography, and descriptive astronomy; economic, social, and philosophical aspects of the subject matter. A three-day field trip is required. This course is recommended for Liberal Studies majors. Lecture three hours each week. This course fulfills the core curriculum lecture requirement in the natural sciences. Fee for the field trip for those not concurrently enrolled in PSCI 215-CL.

PSCI-215CL Fundamentals of Earth Science Lab 1 Credit

Co-Requisite: PSCI-215C

PSCI-216 Fundamentals of Physical Science 4 Credits

This course in physical science presents materials in physics, chemistry, and astronomy that are conceptual in nature with minimal reliance on the quantitative rules of mathematics as a tool for understanding. A strong emphasis is placed on proper use of vocabulary words to understand and explain topics in the fields of mechanics, properties of matter, heat, sound, electricity and magnetism, and light. Classroom demonstrations and videos are used to assist the student in learning the everyday principles of nature. Lab fee. (meets Natural Science/Math requirement)

PSCI-216C Fundamentals of Physical Science 3 Credits

This course in physical science considers topics in physics, chemistry, and astronomy that are conceptual in nature with minimal reliance on the quantitative rules of mathematics as a tool for understanding. A strong emphasis is placed on proper use of vocabulary words to understand and explain topics in the fields of mechanics, properties of matter, heat, sound, electricity and magnetism, and light. This course fulfills the core curriculum lecture requirement in the natural sciences. Lecture three hours per week.

PSCI-216CL Fundamentals of Physical Science Lab 1 Credit

An introduction to laboratory practice and procedure in physical science and exercises in mechanics, properties of matter, heat, sound electricity, magnetism, and light. This course fulfills the core curriculum laboratory requirement in the natural sciences. Laboratory Fee.

PSCI-223C Mechanics of Solids and Fluids 3 Credits

This calculus-based course is designed for students with majors in the engineering and physical sciences. The course focuses on the mechanics of solid and fluids. Topics include statics, equilibrium of rigid bodies, free-body diagrams, parallel and rigid body kinematics, linear and angular motion, impulse and momentum, static and dynamic friction, elasticity, fluid properties, laminar and turbulent flow and fluid statics.

Prerequisite: MATH-180C

Co-Requisite: PSCI-223CL or PSCI-223CR

PSCI-223CL Mechanics of Solids and Fluids Lab 1 Credit

Laboratory will include experiments in the areas of statics and dynamics of particles and rigid bodies in two and three dimensions, static and dynamic friction, linear and angular momentum, fluid properties, laminar and turbulent flow and fluid statics. Laboratory three hours. Lab fee.

Prerequisite: MATH-180C

Co-Requisite: PSCI-223C



PSCI-225 Electricity and Magnetism 3 Credits

This calculus-based course is designed for students with majors in the engineering and physical sciences. This course focuses on the mathematical and physical description of electrostatics, electric field and potential, electrical fundamentals (charge, current, voltage, resistance, power, energy), DC circuit analysis with Ohm's Law and Kirchhoff's Law, AC circuit analysis with phase diagrams, measuring devices (e.g., voltmeter, ammeter), capacitance, magnetic fields and their effect on moving charges and currents, magnetic fields produced by various current configurations, induced emf, mutual and self-inductance, basic theory of dielectrics, magnetic properties of materials and Maxwell's Equations in integral and differential form.

Prerequisite: PSCI-223C

Co-Requisite: PSCI-225L

PSCI-225L Electricity and Magnetism Lab 1 Credit

Laboratory will include experiments in the areas of electrostatics, DC and AC circuits, magnetic fields, and electromagnetic induction. Laboratory three hours. Lab fee.

Pre- or Co-Requisite: PSCI-225

PSCI-227 Waves, Optics and Modern Physics 3 Credits

This course is designed for students with majors in the engineering and physical sciences. Topics covered include geometric and physical optics, waves and the interaction of light and matter, introductory quantum mechanics, solid state physics, nuclear physics and special relativity.

Prerequisite: Take PSCI-225

Pre- or Co-Requisite: #Take MATH-281;

PSCI-227L Waves, Optics, and Modern Physics Lab 1 Credit

Laboratory will include experiments in the areas of mechanical wave motion, sound, interference, geometrical optics, interference, diffraction and polarization of light, radioactivity and the photoelectric effect.

Laboratory three hours. Lab fee.

Pre- or Co-Requisite: Take PSCI-227

PSCI-291 Special Topic: 1 Credit

Study of a special topic in physical science. May be repeated for credit. May have a lab fee.

PSCI-292 Special Topic: 2 Credits**PSCI-293 Special Topic: 3-4 Credits****PSCI-294 Special Topic: 4 Credits****PSCI-470 Special Topic: 3-4 Credits**

Special topics in physical science. May be repeated for credit. May have a lab fee.

