



ACADEMY
FOR MATH, ENGINEERING & SCIENCE

COURSE CATALOG

2018-2019

AMES Counseling Center

Denece Taylor Begay - Counselor Students Last Name A-K
Kari Gardner - Counselor Students Last Name L-Z
Susan McHenry - Counseling Secretary
Jowee Upshaw - Registrar

Academy for Math, Engineering & Science
5715 South 1300 East
Salt Lake City, UT 84121
801-278-9460

Denece Taylor-Begay, ext. 105
Kari Gardner, ext. 104
Susan McHenry, ext. 108
Jowee Upshaw, ext. 107

AMES GRADUATION REQUIREMENTS

Students must earn a total of 27.5 Units of Credit

The following credits can be earned through the AMES curriculum. Credits may also be earned through accredited programs including higher education, independent study, Cottonwood High School, U of U High School University Program or other accredited alternatives. *Discuss outside options with your counselor prior to enrolling in courses.*

Language Arts 4.0 Credits

English 9-11 (1.0 Credit each)
English 12 (1.0 Credit) OR U of U Writing 1010 (0.5 AMES Credit & 3.0 of U of U Credit)
U of U Writing 2010 (0.5 AMES Credit & 3.0 of U of U Credit)

AMES Elective Language Art Courses:

Creative Writing (0.5 Credit), Humanities-Introduction to World Religions (0.5 Credit),
Humanities through Film (0.5 Credit), Secondary Reading (0.5 Credit),

Mathematics 4.0 Credits

Secondary Math 1 or 1 H, Secondary Math 2 or 2 H, Secondary Math 3 or 3 H (1.0 Credit each)

College Prep Math (1.0 Credit)
AP Calculus AB (1.0 Credit)
U of U Introduction to Quantitative Reasoning 1030 (0.5 AMES Credit & 3.0 U of U Credit)
U of U Elementary Statistics 1040 (0.5 AMES Credit & 3.0 U of U Credit)
U of U College Algebra 1050 (0.5 AMES Credit & 4.0 U of U Credit)
U of U Trigonometry 1060 (0.5 AMES Credit & 3.0 U of U Credit)
U of U Calculus I 1210 (0.5 AMES Credit & 4.0 U of U Credit)
U of U Calculus II 1220 (0.5 AMES Credit & 4.0 U of U Credit)

Science 4.0 Credits

Biology Honors (1.0 Credit), Chemistry Honors (1.0 Credit), Physics with Technology (1.0 Credit),
Physics Honors (1.0 Credit), Geology (1.0 Credit), Environmental Science (1.0 Credit)

U of U General Chemistry I 1210 (0.5 AMES Credit & 4.0 U of U Credit)
U of U General Chemistry II 1220 (0.5 AMES Credit & 4.0 U of U Credit)
U of U General Chemistry Lab I 1215 (0.25 AMES Credit & 1.0 U of U Credit)
U of U General Chemistry Lab II 1225 (0.25 AMES Credit & 1.0 U of U Credit)
U of U Physics for Scientists and Engineers I 2210 (0.5 AMES Credit & 4.0 U of U Credit)
U of U Physics for Scientists and Engineers II 2220 (0.5 AMES Credit & 4.0 U of U Credit)

AMES Elective Science Courses:

Astronomy (0.5 Credit), Earth Science (1.0 Credit), Electronics I (0.5 Credit),
Engineering Foundations (1.0 Credit), Science Fair Research (0.5 Credit),
Engineering Principles I (0.5 Credit), Engineering Principles II (0.5 Credit)

Social Studies 3.5 Credits

Human Geography Honors (1.0 Credit), World History Honors (possible AP Credit) (1.0 Credit),
U.S. History Honors (possible AP Credit) (1.0 Credit),
U.S. Government & Citizenship (possible AP Credit) (0.5 Credit)

AMES Elective Social Studies Courses

AP Psychology (1.0 Credit)

Computer Science **1.0 Credit**
 Exploring Computer Science (0.5 Credit)

AMES Elective Computer Science Courses
 A+ Computer Repair/Maintenance (0.5 Credit), AP Computer Science (1.0 Credit), Introduction to Information Technology (0.5 Credit), Programming 1 (VEX Robotics) (1.0 Credit), Programming 2 (C++, Java, Android APP Development) (1.0 Credit), Robotics I (Arduino) (0.50 Credit), Robotics II (0.50 Credit)

Fine Art **1.5 Credits**
 AP Art (1.0 Credit)
 Art Honors (1.0 Credit)
 Drawing 1 (0.5 Credit)
 Drawing 2 (0.5 Credit)
 Painting 1 (0.5 Credit)
 Painting 2 (0.5 Credit)
 Commercial Art 1 (0.5 credit)
 Commercial Art 2 (0.5 credit)

Art classes taken through Cottonwood High School will also satisfy this requirement.

World Language **2.0 Credits**
 To meet requirement student must take two progressive years of the same foreign language.
 Spanish 1 (1.0 Credit), Spanish 2 (1.0 Credit), Spanish 3 (1.0 Credit), Arabic 1 (1.0 Credit), Arabic 2 (1 Credit), Russian 1 (1.0 Credit), Russian 2 (1.0 Credit)

World Languages taken through Cottonwood High School will also satisfy this requirement.

Applied Technology Internship/Work Based Learning **1.0 Credit**
 Internship (1.0 Credit)

Physical Education **1.5 Credits**
 Aikido (0.5 Credit)
 Walking for Fitness (0.5 Credit)
 Lifetime Fitness Packet through AMES (0.5 Credit) Students may do 1 packet per year.
 Athletic participation on high school teams (0.5 Credit)

P.E. classes taken through Cottonwood High School will also satisfy this requirement.

Health Education **0.5 Credit**
 Health (0.5 Credit)

Financial Literacy **0.5 Credit**
 Financial Literacy (0.5 Credit)

College/Forum Senior Project and Portfolio **1.0 Credit**
 Grade 9-11 College Forum (0.75 Credit by end of 11th Grade)
 Senior Project & Portfolio (seniors only 0.25 Credit)

Elective Credits **3.0 Credits**
 Courses taken through AMES that do not satisfy any of the above credit requirements will be placed as elective credit for students.

Chess Fundamentals (0.50)
 Yearbook (1.0 Credit)
 U of U Social Construction of Race & Gender I UGS 2001 (0.50 AMES Credit & 3.0 U of Credit)
 U of U Social Construction of Race & Gender II UGS 2002 (0.50 AMES Credit & 3.0 U of Credit)

COURSE CATALOG

Not all classes are offered each year, check with counseling center for more information.

LANGUAGE ARTS (4 Credits Required)

ENGLISH 9

(1.0 Credit)

9th grade

Prerequisite: None

The ninth grade language arts course connects reading instruction with writing for multiple purposes. Writing focuses heavily on argument writing, but also works with narrative and expository writing. The course continues intensive practice and study of informational and literary reading and writing. Students read extensively from a variety of sources, and draft, revise, and edit their own writing.

ENGLISH 10

(1.0 Credit)

10th grade

Prerequisite: English 9

The tenth grade language arts course continues the intensive practice and study of informational and literary writing. Students read extensively from a variety of sources. They draft, revise, and edit their own writing. This course is designed to teach students strategies in reading comprehension, writing, listening, speaking, and critical viewing.

ENGLISH 11

(1.0 Credit)

11th grade

Prerequisite: English 10

College preparatory language arts is a reading and writing intensive course designed to prepare eleventh grade students for college-level writing their senior year. This course teaches students strategies in critical reading, academic and narrative writing, active listening, and effective speaking.

ENGLISH 12

(1.0 Credit)

12th grade

Prerequisite: English 11

English 12 is designed to further develop students' in their critical reading, academic and narrative writing, active listening, and effective speaking. In this class, students will grapple with challenging texts, assignments, and ideas. Additionally, students will fine-tune writing skills to prepare twelfth graders for college.

WRTG 1010 - Introduction to Academic Writing

(0.5 AMES Credit, 3.0 University of Utah Credit)

12th grade

Prerequisite: Must show a "B" Average in Language Arts 11

Students learn to read and write rhetorically, develop and support claims, and produce and evaluate writing in collaboration with peers. Course readings and assignments emphasize writing for diverse purposes and disciplines.

WRTG 2010 - Intermediate Writing: Academic Writing and Research

(0.5 AMES Credit, 3.0 University of Utah Credit)

12th grade

Prerequisite: Minimum grade of C- or better in WRTG 1010

Writing in undergraduate academic contexts. Students practice analytical and persuasive writing that addresses various academic audiences in a research university. Emphasis on writing for learning, textual analysis, writing from research, and collaborative writing.

Elective Language Art Courses

CREATIVE WRITING

(0.5 Credit)

9-12 Grades

Prerequisite: None

This course is designed for any student who desires to focus on creative writing and is willing to experiment using a variety of literary genres. Students will explore their own creative voice through writing practice, role playing, discussion of other student writing, and published writings. Writing will be shared with the class in an open forum of discussion about the work and how to craft each piece. This is a class for students who are motivated and highly self-disciplined.

HUMANITIES – INTRODUCTION TO WORLD RELIGIONS

(0.5 Credit)

9-12 Grades

Prerequisites: None

Introduction to World Religions is an elective course designed to introduce students to the major religions of the world. The main focus of this course will be making students aware of the variety of religious practices found all over the globe, but especially in the United States. Students will be expected to be critical thinkers and active participants in regular classroom discussions, and be prepared for class with required readings and supplies.

HUMANITIES THROUGH FILM

(0.5 Credit)

9-12 Grades

Prerequisites: None

Humanities: Introduction to Philosophy focuses on the key questions of philosophy and examines them from the perspectives of film and modern culture with the goal of developing critical thinking skills and a basic understanding of philosophy, contemporary issues, social theory and how we relate to our world. Some of the questions addressing include: What is reality? What is identity? How do you determine what is of value? The specific areas of philosophy examined include epistemology, logic, ethics, aesthetics, value theory, and metaphysics.

SECONDARY READING

(0.5 Credit)

9th & 10th Grades

Secondary Reading is a course designed to improve reading comprehension and vocabulary for students reading below grade level by teaching specific reading strategies. The goal is to bring students to grade level in reading and insure that they are able to get the most from the educational opportunities AMES has to offer.

MATHEMATICS (4 Credits Required)

SECONDARY MATH 1

(1.0 Credit)

9th grade

Prerequisite: 8th Grade Mathematics.

In this course students represent, analyze, and explore real number patterns from tables, graphs, verbal rules, and equations. Emphasis is on linear and quadratic relationships and their applications. Students learn concepts through concrete models. *A graphing calculator is required.*

SECONDARY MATH 1 HONORS

(1.0 Credit)

9th grade

Prerequisite: 8th Grade Mathematics Honors

Students explore linear, quadratic, and exponential models for real-world problems. Arithmetic and geometric sequences and their connection to linear and exponential functions are investigated. Students will prove geometric theorems using coordinate geometry. Students will use vectors to investigate trigonometric ratios and transformations of functions. *A graphing calculator is required.*

SECONDARY MATH 2

(1.0 Credit)

10th grade

Prerequisite: Math 1 and Teacher Recommendation

Students continue to explore mathematical modeling of real-world problems, extending their knowledge of functions to quadratics, logarithms and trigonometry. Students will use the rules of probability to compute probabilities of compound events in a uniform probability model and use probability to evaluate outcomes of decisions. *A graphing calculator is required.*

SECONDARY MATH 2 HONORS

(1.0 Credit)

9th & 10th grade

Prerequisite: A or B grades in Math 1 Honors and Teacher Recommendation

Students continue to explore mathematical modeling of real-world problems, extending their knowledge of functions to quadratics, logarithms and trigonometry. Students will use the rules of probability to compute probabilities of compound events in a uniform probability model and use probability to evaluate outcomes of decisions. *A graphing calculator is required.*

SECONDARY MATH 3

(1.0 Credit)

11th grade

Prerequisite: Math 2 and Teacher Recommendation

The study of functions is the primary focus of this class, including: quadratic, polynomial, radical, trigonometric, and probability functions. Complex numbers are introduced. In addition to algebraic methods for solving equations, students use technology to solve equations numerically and graphically. *A graphing calculator is required.*

SECONDARY MATH 3 HONORS

(1.0 Credit)

9 – 11th grade

Prerequisites: A or B grades in Math 2 Honors and Teacher Recommendation

This course extends the study of functions to include exponential, logarithmic, rational, and advanced trigonometric ones. Students explore many of the concepts fundamental to Calculus, including Riemann sums and limits. Vectors and matrices are also covered. *A graphing calculator is required.*

COLLEGE PREPATORY MATH

(1.0 Credit)

12th grade

Prerequisites: Completion of Math 1, 2 and 3

Students investigate many of the same topics covered in Math 2 and Math 3 but in more detail. This course is for students who are not ready to take college level math their senior year.

AP CALCULUS AB

(1.0 Credit)

9 – 12th grade

Prerequisite: A or B grade in Math 3 Honors or Teacher Recommendation

This course will prepare students for the AP Calculus AB Test. This calculus course includes topics typically taught in a first semester college calculus course: Functions, graph, and limits; Derivatives and applications of derivatives; Integrals and applications of integrals. *A graphing calculator is required.*

University of Utah MATH Courses offered at AMES

MATH 1030 - INTRODUCTION TO QUANTITATIVE REASONING

(0.50 AMES Credit 3.0 University of Utah Credit)

Prerequisites: Completion of Math I, II, II with an average grade of "C" or better OR ACT Math Score 19 or better OR Accuplacer EA score of 60 or better OR SAT Math Score of 500 or better. This course helps students learn how to use some simple mathematical techniques effectively in their own field of study and apply those concepts to practical, real-life situations. Topics covered: sets and Venn diagrams, different systems of units and unit conversions, using percents and estimations, financial mathematics involved in loans and investments, linear and exponential modeling and applications, geometric measurements and scaling. This course is primarily for undergraduate students who will not take any further mathematics, except for statistics/probability.

MATH 1040 - ELEMENTARY STATISTICS

(0.50 Credit, 3.0 University of Utah Credit)

Prerequisites: C or better in any of the following U or U 1010, 1030, 1050, 1070, 1080 or 1090 or Accuplacer CLM score of 50, or ACT Math score of 23, or SAT Math score of 540

We will learn how to collect, organize, analyze, display and interpret data; deviation, variance and standard deviation, Empirical rule; probability distributions, binomial distributions; standard normal (bell-shaped) distributions, correlation and linear regression.

MATH 1050 - COLLEGE ALGEBRA

(0.50 Credit, 4.0 University of Utah Credit)

Prerequisites: "C" or better in (MATH 1060) OR Accuplacer \geq 60 or better OR ACT Math score of 23 or better OR SAT Math score of 540 or better.

Functions, inverses and graphs; polynomial, rational, radical, exponential and logarithmic functions; systems of equations and matrices; applications; arithmetic and geometric sequences and series.

MATH 1060 - TRIGONOMETRY

(0.50 Credit, 3.0 University of Utah Credit)

Prerequisites: Prerequisites: "C" or better in MATH 1050 OR Accuplacer \geq 80 or higher.

Trigonometric functions, inverses, equations and identities with applications; introduction to vectors.

MATH 1210 - CALCULUS I

(0.50 Credit, 4 University of Utah Credit)

Prerequisites: Prerequisites: "C" or better in ((MATH 1050 AND MATH 1060) OR AP Calculus AB score of 3 or better OR Accuplacer \geq 90 or better OR ACT Math score of 28 or better OR SAT Math score of 630 or better.

Functions and their graphs, differentiation of polynomial, rational and trigonometric functions. Velocity and acceleration. Geometric applications of the derivative, minimization and maximization problems, the indefinite integral, and an introduction to differential equations. The definite integral and the Fundamental Theorem of Calculus.

MATH 1220 - CALCULUS II

(0.50 Credit, 4 University of Utah Credit)

Prerequisites: Prerequisites: "C" or better in (MATH 1210 OR AP Calculus AB score of at least 4 OR AP Calculus BC score of at least 3.

Geometric applications of the integral, logarithmic, and exponential functions, techniques of integration, conic sections, improper integrals, numerical approximation techniques, infinite series and power series expansions, differential equations (continued).

Potential Mathematics Course Sequences

9 th Grade	10 th Grade	11 th Grade	12 th Grade
Sec. Math 1	Sec. Math 2	Sec. Math 3	College Prep Math or MATH 1030/1040 or MATH 1050/1060
Sec. Math 1 Honors	Sec. Math 2 Honors	Sec. Math 3 Honors	MATH 1050/1060 or AP Calculus AB or MATH 1210/1220 or MATH 1040
Sec. Math 2 Honors	Sec. Math 3 Honors	AP Calculus AB	MATH 1210/1220 or MATH 1040
		MATH 1210/1220	MATH 1040 or U of U MATH Courses**

***After successful completion of MATH 1210/1220, some AMES students choose to continue their study of Math by applying to the HSUP(<http://admissions.utah.edu/hsup/>) and enrolling in higher level Math courses at the U.*

SCIENCE (4.0 Credits Required)

BIOLOGY HONORS

(1.0 Credit)

Prerequisites: None

Honors Biology is a two-semester course with an emphasis throughout on developing writing skills in the sciences. Built into the course is a laboratory component for most topics covered and culminates with a fetal pig dissection. This hands-on experience is designed to give the students a kinetic and visual learning opportunity to coincide with the lecture (auditory) portion of instruction. Topics covered include but are not limited to the following: ecology and environmental science, chemistry of living cells, cells, genetics, evolution, classification/taxonomy, biological diversity and organs and organ systems.

CHEMISTRY HONORS

(1.0 Credit)

Prerequisites: Biology and Math 1

Chemistry is the study of matter and its properties. This class is designed to provide you with a solid background in chemistry, touching briefly on the different aspects of chemistry. Topics covered will include scientific measurements, the properties and changes of matter, atomic structure, electron configuration, chemical bonding, reactions, the mole concepts, chemical equilibrium, acids and bases, electrochemistry and nuclear chemistry. An emphasis is placed on quantitative relationships of the principles covered. Students will develop an understanding of chemical concepts and the relevance of chemistry in their lives. (Scientific Calculator Required)

PHYSICS WITH TECHNOLOGY

(1.0 Credit)

Prerequisite or co-requisites: Math 2 or higher

This course is physics for students who are sure they won't go into careers in science, medicine, or engineering but who still want to understand the natural laws that govern the world around us. Topics include: motion, energy, momentum, electricity, sound, light, magnetism, and other physical phenomenon. Students will become skilled at making observations, measurements, and predictions about how the world around them behaves.

The difference between this Physics with Technology class and the Honors Physics class is that the Physics with Technology does not use quite as much math, although it definitely does still use math. This class focuses more on understanding of general physics principles and less on quantitative problem solving.

PHYSICS HONORS

(1.0 Credit)

Prerequisite or co-requisite: Math 3 or higher

This course is physics for students who think they might possibly go on to careers in science, medicine, or engineering even if they aren't yet sure of that choice. Topics include: motion, energy, momentum, electricity, sound, light, magnetism, quantum mechanics, relativity, and other physical phenomenon. Students will become skilled at making observations, measurements, and predictions about how the world around them behaves.

The difference between this Physics Honors class and the Physics with Technology class is that the Physics Honors class uses more math and students will solve more complex problems. Students who are thinking they might want to major in science, medicine, or engineering when they go to college should definitely take this class instead of Physics with Technology even if they aren't sure yet of their major.

ENVIRONMENTAL SCIENCE

(1.0 Credit)

Prerequisite: Biology

Environmental Science is a multidisciplinary field of study that integrates physical and biological sciences. In this class we will be studying the environment through the lenses of biology, chemistry, physics, geology, ecology, zoology, mineralogy, atmospheric science, economics and sociology. We will be using case studies to further the application of theoretical concepts. Students will use the concepts learned from the class to do a research project on an environmental problem of their choosing for their final project.

GEOLOGY

(1.0 Credit)

10-12 Grades

Prerequisites: None

The Earth is an astronomical object, which also happens to be our home. It is the product of a long series of events, which resulted in a structurally complex body hosting numerous dynamic processes such as volcanism, tectonics, sedimentation and weather. The specific dynamic nature of our planet has produced an environment, which promoted the development of life and was subsequently modified by life into the extremely habitable state in which it currently exists. The purpose of this class is to investigate the processes that produced our home world and which currently act to nurture us but which can threaten us as well. By understanding the systems and processes, which are vital to the maintenance of a habitable world, the students learn the importance of being responsible stewards of the environment.

University of Utah SCIENCE Courses offered at AMES

CHEM 1210 - GENERAL CHEMISTRY I

(0.5 AMES Credit, 4.0 University of Utah Credit)

Prerequisite: "C-" or better in MATH 1050, 1210 or 1220 OR Accuplacer 75+ OR Math ACT of 25+ OR Math SAT of 600+ OR AP Calc AB/BC of at least 2.

Co-requisites: CHEM 1215

Three lectures, two discussions per week. Fundamentals of chemistry emphasizing descriptive and modern applied chemistry for science and engineering majors. Topics include atomic theory, molecular bonding, and reaction chemistry.

CHEMISTRY 1215 - GENERAL CHEMISTRY LAB I

(0.25 AMES Credit, 1.0 University of Utah Credit)

Co-requisites: "C-" or better in CHEM 1210 OR CHEM 1211 OR AP Chemistry score of at least 4.

Must be taken concurrently with CHEM 1210. One lecture and one 3 hour lab per week.

One lecture per week, one three-hour laboratory/discussion per week. (Must be taken concurrently with Chem. 1210.)

CHEM 1220 - GENERAL CHEMISTRY II

(0.50 AMES Credit, 4.0 University of Utah Credit)

Prerequisite: "C-" or better in CHEM 1210 OR AP Chemistry score of at least 4.

Co-requisites: CHEM 1225

Continuation of CHEM 1210.

CHEM 1225 - GENERAL CHEMISTRY LAB II
(0.25 AMES Credit, 1.0 University of Utah Credit)

Co-requisites: CHEM 1210 & 1220

Must be taken concurrently with CHEM 1220. One lecture and one 3 hour lab per week.

One lecture per week, one three-hour laboratory/discussion per week. (Must be taken concurrently with Chem. 1220.)

PHYS 2210 - PHYSICS for SCIENTISTS and ENGINEERS I
(0.50 AMES Credit, 4.0 University of Utah Credit)

Prerequisite: A grade of C or better in MATH 1210 or co-enrollment in MATH 1210 and Teacher Recommendation

Three lectures and two recitations weekly. Designed to give science and engineering students a thorough understanding of the basic physical laws and their consequences. Classic mechanics will be introduced, including methods of energy, momentum, angular momentum, and Newtonian gravity. Applications will include mechanical oscillations, sound, and wave motion. Those engineering students who have not had calculus before (high school or college-level course), need to see an engineering advisor.

PHYS 2220 - PHYSICS for SCIENTISTS and ENGINEERS II
(0.50 AMES Credit, 4.0 University of Utah Credit)

Prerequisite: C or better in PHYS 2210 and co-enrollment in MATH 1220.

Physics for Scientists and Engineers II (4) Prerequisite: PHYS 2210 and MATH 1220.

Three lectures and two recitations weekly. The continuation of PHYS 2210. Electrostatics, electric fields, and potential. Magnetic fields and Faraday's law. Current flow, resistance, capacitance and inductance. Electric circuits and electromagnetic oscillations. Electromagnetic waves, geometric and physical optics.

Elective Science Courses

ASTRONOMY
(0.5 Credit)

10-12 Grades

Prerequisites: None

This is a general survey class of Astronomy. Many of the significant discoveries and paths to our current understanding of the science will be investigated through the long history of Astronomy. As the history progresses, various lab experiences will be utilized to help the student understand the principles in question. Students will also investigate concepts describing the origin and evolution of the universe, as well as many of its astronomical components, as they are currently accepted by mainstream science. Through an understanding of the main ideas of Astronomy, the student gains insight of their place as physical beings living in a physical universe.

EARTH SCIENCE
(1.0 Credit)

Prerequisite: None

Topics covered include the development of the universe and solar system, the evolution of Earth's environment and how this affects living systems, and the uniqueness of life on earth, the movement of Earth's plates caused by gravity, density, and convection, and the impact this has on other systems, water cycles in the hydrosphere and the effect on other spheres, Earth's atmosphere and its interaction with the lithosphere, hydrosphere, and biosphere, and the source and distribution of energy on Earth and its effects on Earth systems.

ELECTRONICS 1
(0.5 Credit)

No prerequisites

This course prepares students to design, assemble, install, operate, maintain, and repair electrical/electronic equipment used in robotics, business, industry, and manufacturing. It includes training in safety, electrical theory, parallel and series circuits, Kirchoff's Laws, and schematic diagrams. Students will use various electrical equipment including volt meters, ohm meters, ammeters, oscilloscopes, soldering tools, and power supplies. They will design and build circuits that include resistors, capacitors, potentiometers, transistors, diodes, integrated circuits, and many more.

ENGINEERING PRINCIPLES 1

(0.50 Credit)

Prerequisite: None.

This class is an introduction to the field of engineering. Students learn about various engineering disciplines (Mechanical, Electrical, Software, and Civil Engineering) and they develop skills for solving engineering problems. A key goal of the class is for students to gain hands-on experience designing, building, and debugging engineering projects.

ENGINEERING PRINCIPLES 2

(0.50 Credit)

Prerequisite: None. (Although students are encouraged to take the Engineering Principles 1 class prior to taking this Engineering Principles II class, it's not necessary that they do so.)

This class is an introduction to the field of engineering. Students learn about various engineering disciplines (Aeronautical, Chemical, Materials, and Bio Engineering) and they develop skills for solving engineering problems. A key goal of the class is for students to gain hands-on experience designing, building, and debugging engineering projects.

SCIENCE FAIR RESEARCH – Offered 1st Semester Only

(0.5 Credit)

10-12 Grades (*9th Grade with previous science fair experience and teacher recommendation)

Prerequisites: Application required, available from instructor

Students will experience science as a process while working on a research or engineering project of their choice. Student interest and class projects will define laboratory and classroom curriculum. Workshops, lectures and laboratory tours, hosted by University of Utah scientists, will be part of the learning experience. Reading, writing and analytical skills important to high school and collegiate success will be an integral part of each project. Outstanding final projects/reports will be used in local and national research competitions as well as college scholarship applications. **Individual projects and teams of two only.*

SOCIAL STUDIES (3.5 Credits Required)

HUMAN GEOGRAPHY HONORS

(1.0 Credit)

9th Grade

Prerequisite: None

During the Freshman year, students will examine themes, patterns, and processes from a global perspective. Students will examine the historical record from 8000 BCE to the Enlightenment (Periods 1-4). This course covers a wide range of cultures, religions, people and events. Special emphasis will be given to regions and societies traditionally underrepresented in world history course. Using the five themes of AP Human Geography and the “Four Historical

Thinking Skills” for social studies the course will follow the course outline as described by the College Board.

This foundational course will focus on developing the historical and geographical college readiness skills necessary to prepare students for participation in the AP option during their sophomore year.

WORLD HISTORY HONORS (AP Option available)

(1.0 Credit)

10th Grade

Prerequisite: none

During sophomore year students will examine themes, patterns, and processes from a global perspective. Students will examine the historical record from the Industrial Revolution to present day (Periods 5-6) with an emphasis on current issues. Students will participate in the Utah History Day, and have the opportunity to pursue the AP option. Using the five themes of AP World History and the “Four Historical Thinking Skills” for social studies the course will follow the course outline as described by the College Board.

*This course is designed to assist students who elect to take the AP World History test in the spring. However, students who select this AP option will need to engage in additional study activities and review throughout the year to be sufficiently prepared for the AP test, and to meet the criteria to have their transcript changed to reflect an AP course.

**The 2017 AP fee is \$93 per test (subject to change).*

U.S. HISTORY (AP Option available)

(1.0 Credit)

11th Grade

Prerequisite: None

United States History will provide students with a comprehensive look into the history of the United States and its development from colonization through the twentieth century. It is designed to engage students in the rigor of a college-level course. We will explore such themes as politics, culture, war, diplomacy, diversity, environment, economics, and reform.

*This course is designed to assist students who elect to take the AP United States History test in the spring. However, students who select this AP option will need to engage in additional study activities and review throughout the year to be sufficiently prepared for the AP test, and to meet the criteria to have their transcript changed to reflect an AP course.

**The 2017 AP fee is \$95 per test (subject to change).*

UNITED STATES GOVERNMENT AND CITIZENSHIP (AP Option available)

(0.5 Credit)

12th Grade

Prerequisites: None

United States Government and Citizenship focuses on the elements of democracy, the structure of government, and the role of the individual as an active participant in our democracy. Upon completion of the class, students should feel they have an understanding of the origin and structure of American democracy, the organization and functions of government, the fundamentals of *The Constitution*, and how they, as individuals, can make a difference as U.S. citizens.

*This course is designed to assist students who elect to take the AP United States Government test in the spring. However, students who select this AP option will need to engage in additional study activities and review throughout the year to be sufficiently prepared for the AP test, and to meet the criteria to have their transcript changed to reflect an AP course.

**The 2017 AP fee is \$93 per test (subject to change).*

Elective Social Studies Courses

AP PSYCHOLOGY

(1.0 Credit)

11-12th Grade Only

Prerequisites: Teacher approval and signature required for registration

AP Psychology is a college-level survey course, designed to prepare students for the AP Exam in May. Psychology is the study of behavior and mental processes, and this course is intended to introduce students to the concepts, principles, theories, and theorists in the major fields of Psychology. We will also examine the methods used by researchers in these fields and the changing ethical guidelines that regulate them. This is a reading and writing intensive course that will require students to spend significant time outside of class for study and homework.

**The 2017 AP fee is \$93 per test (subject to change).*

COMPUTER SCIENCE

(1.0 Credit Required)

EXPLORING COMPUTER SCIENCE

(0.5 Credit)

Prerequisite: Computer Technology

Exploration of Computer Science will challenge students to discover the underlying principles of Computer Science and apply those principles through the use of critical thinking, problem solving, decision making, hands-on activities, and team effectiveness. It facilitates not only the mastery of technological subject matter such as programming logic but, a mastery of the process of learning. AMES Computer Science promotes individual exploration, creativity, innovation and encourages team collaboration.

Elective Computer Science Courses

A+ COMPUTER REPAIR/MAINTENANCE

(0.5 Credits)

Prerequisites: Computer Technology/Introduction to Information

In this course, students practice troubleshooting, maintenance, and upgrade of PCs. Course content covers setup, memory management, data back-up, and hardware/software diagnostic procedures. The course is designed to prepare students for the Comp TIA A+ certification exam. A+ certification is a testing program that certifies the competency of entry-level (9 month's experience) service technicians in the computer industry. Earning A+ certification means that the individual possesses the knowledge, skills, and customer relation skills essential for a successful entry-level computer service technician as defined by experts from companies across the industry.

PROGRAMMING 2 (C++, Java, Android APP Development) (being taught 2017-2018 school year)

(1.0 Credit)

Prerequisite: Programming 1 or Teacher Approval

Computer programming II will provide students an opportunity to develop a skill that will help them better understand computer functionality and how industry develops useful applications. Students will learn and understand the principles of software development. Students will use such concepts as flowcharting, code supportability, and object oriented code design. Students will learn how to develop programs using C++, Java and applications for the android phone operating system.

AP COMPUTER SCIENCE (Taught Every Other Year – Next taught 2018-19 School Year)

(1.0 Credits)

Prerequisites: Exploring Computer Science

The goals of the AP Computer Science course are comparable to those in the introductory course for computer science majors offered in many college and university computer science departments. It is not expected that all students in the AP Computer Science course will major in computer science at the university level. The AP Computer Science course is intended to serve both as an introductory course for computer science majors and as a course for people who will major in other disciplines and want to be informed citizens in today's technological society.

The following goals apply to the AP Computer Science course. Students should be able to:

- design, implement, and analyze solutions to problems.
- use and implement commonly used algorithms.
- use standard data structures.
- develop and select appropriate algorithms and data structures to solve new problems.
- write solutions fluently in an object
- oriented paradigm.
- write, run, test, and debug solutions in the Java programming language, utilizing
standard Java library classes and interfaces from the AP Java subset.
- read and understand programs consisting of several classes and interacting
objects.
- read and understand a description of the design and development process leading
to such a program.
- understand the ethical and social implications of computer use.

INTRODUCTION TO INFORMATION TECHNOLOGY

(0.5 Credit)

Prerequisite: Computer Technology

Information Technology incorporates computer activities into almost every aspect of its operation, yet it goes well beyond computer screen instructions. Students will first understand the computer hardware functionality and the computer operating system (Windows 7). Software applications such as Photoshop, Premier, Audacity and Flash will be explored. Students will also program a basic calculator using C++. This class will give students an opportunity to do research about technological topics, work in a team environment, write technical reports and give oral presentations.

PROGRAMMING 1 (VEX ROBOTICS)

(1.0 Credit)

10-12th Grades

Prerequisites: Computer Technology

Students will be introduced to programming concepts and design logic. The programming language will be C. Students will learn about Top/Down design methods, variables, loops, arrays and structures. The students will also apply their knowledge by learning how to control robots using the Adriano microprocessor. Students will learn how to work with in a development team as they design, build and program a working robot. Students will also learn about career opportunities in the programming and robotics industry.

ROBOTICS I (ARDUINO)

(0.5 Credit)

Prerequisites: None

The first in a sequence of courses that prepares individuals with a lab-based, hands on curriculum combining electrical, mechanical and engineering principles. Students will learn to design, build, program, and control robotic devices. A rigorous study and application of electrical concepts will include: sources of energy, electrical safety, use and identification of basic electronic components, sensors and actuators. Engineering concepts will include: mechanical design, prototype development, design testing, programming, and proper engineer documentation.

ROBOTICS II

(0.5 Credit)

Prerequisite: Either the Robotics I class (which focusses on programming) or else programming experience obtained elsewhere

This class is the second in a sequence of courses that prepares students to design, build and program robotic devices. The first course in the sequence focusses more on the programming side of things using pre-made robotic kits. In this second course we throw away the pre-made kits and build the hardware ourselves. In this class students will learn electrical concepts such as: sources of energy, electrical safety, and use of basic electronic components such as sensors and controllers. Students will learn mechanical concepts such as the use of motors, gear boxes, pneumatics, and other actuators as well as proper hardware design techniques, prototype development, testing, and proper engineer documentation.

FINE ART (1.5 Credits Required)

DRAWING 1

(0.5 Credit)

Prerequisite: None

This beginning course introduces and develops competence in students' use of the Elements of Design. Drawing skills and techniques will be developed through the use of a variety of drawing media: graphite, pen and ink, and charcoal. With an emphasis on studio production, this course is intended to develop design skills and higher level thinking skills. Experience in art criticism, art history, and aesthetics will be included.

DRAWING 2

(0.5 Credit)

Prerequisite: Drawing 1 in high school

This intermediate course continues building skills developed in Drawing 1, as well as introducing and developing competence in using the Principles of Design. Projects are more complex and encourage experimentation of drawing media as well as the development of individual creativity and style. With an emphasis on studio production, this course is intended to develop design skills and higher level thinking skills. Experience in art criticism, art history, and aesthetics will be included.

**PAINTING 1
(0.5 Credit)**

Prerequisite: Drawing 1 in high school

This beginning course will focus on the introduction and exploration of water media techniques using transparent watercolor paint and opaque gouache paint. The course will focus on the proficiency of working with color, as well as introducing and developing competence in students' use of the Principles of Design. With an emphasis on studio art production, this course is intended to develop design skills and higher level thinking skills. Experience in art criticism, art history, and aesthetics will be included.

**PAINTING 2
(0.5 Credit)**

Prerequisite: Painting 1 in high school

This is an introductory course to basic oil painting techniques that build on the color concepts taught in Painting 1. Students will learn the skills to paint from observation, to accurately identify and mix color, to create the illusion of depth and realistic form, as well as compositional strategies.

**COMMERCIAL ART 1
(0.5 credit)**

Prerequisite: Drawing 1 in high school. Class fee required.

This class is not open to 9th graders. This beginning course offers an overview of the Elements and Principles of Design used in Advertising, Illustration, and Commercial Art. We will complete projects in both traditional media and digital media. Projects will include logo design and branding, book cover and book layout design, product and packaging design, and more that incorporate the elements and principles of design. Emphasis will be placed on developing the student's ability to plan and think creatively, and effectively communicate those ideas visually. At the end of the semester, the state Commercial Art CTE exam will be administered. If the students pass with 80% or higher they receive a certificate that has a list of skills students achieved in the course. This can be used when filling out resumes and networking with people in the Commercial Art field.

**COMMERCIAL ART 2
(0.5 credit)**

Prerequisite: Drawing 1 and Commercial Art I in high school. Class fee required.

This class is not open to 9th graders. This advanced course offers an in-depth study of the Elements and Principles of Design used in Advertising, Illustration, and Commercial Art. A working knowledge of Adobe Photoshop and Illustrator is required. Emphasis will be placed on building the student's ability to plan and think creatively, and effectively communicate those ideas visually. At the end of the semester, the state Commercial Art CTE exam will be administered if the student has not already passed the exam, and the students will be given the opportunity to participate in Commercial Art competitions.

**AP ART - Two Dimensional Design Portfolio AP/Drawing Portfolio AP
(1.0 Credit)**

Prerequisite: Drawing 1 & Drawing 2, Painting 1 in high school & Portfolio required

This is an advanced college-level course for highly motivated students. Students will work with a variety of art media and art techniques where they focus on the Principles of Design. Students will work from direct observation and are required to shoot their own reference photographs. Students will produce a well-developed portfolio of their original work following the requirements of the College Board Advance Placement Program. University credit can be earned by submitting a portfolio and receiving a passing score at the end of the year.

**ART HONORS
(1.0 Credit)**

Prerequisite: Drawing 1 & 2, and Painting 1 in high school, or teacher approval (possible portfolio) required (This class is an intermediate studio production class and is designed for those students wishing to continue on into AP art. The students will be exploring different media, techniques, and styles, while continuing to improve in their skill level within the visual arts. The class will review various skills and techniques, as well as provide accelerated learning of other visual art issues. Experience in art criticism, art history, and aesthetics will be included.

WORLD LANGUAGE (2.0 Credits Required)

SPANISH 1 (1.0 Credit)

Prerequisite: None

The goal of Spanish 1 is to build the fundamentals of understanding and speaking Spanish and help develop the capacity to use the Spanish language in a meaningful and functional way. The course emphasizes communication skills, foundations of language learning, and understanding of cultures in the Spanish-speaking world. This course introduces grammar concepts with a heavy emphasis on vocabulary-building along with cultural learning from the diverse world of Spanish-speakers, working towards a beginner's level of proficiency. Students will become familiar with such vocabulary as greetings, likes/dislikes, sports, opposites, family, body parts, clothing, food, weather, telling time, days, months, seasons, colors, numbers, shapes, professions, school nouns, places, and feelings.

SPANISH 2 (1.0 Credit)

Prerequisite: Spanish 1

The goal of Spanish 2 is to continue to build the fundamentals of understanding and speaking Spanish developing a greater capacity to use the Spanish language in a meaningful and functional way. The course emphasizes proficient communication skills, foundations of language learning, and understanding of cultures in the Spanish-speaking world. This course continues the introduction of grammar concepts with a special focus on all the verb tenses (except the subjunctive) along with cultural learning from the diverse world of Spanish-speakers, working towards an intermediate level of proficiency. Students will review and extend their ability with such vocabulary as greetings, likes/dislikes, sports, opposites, family, body parts, clothing, food, weather, telling time, days, months, seasons, colors, numbers, shapes, professions, school nouns, places, and feelings.

SPANISH 3 (1.0 Credit)

Prerequisite: Spanish 1 & 2

The goal of Spanish 3 is to continue to build the fundamentals of understanding and speaking Spanish developing a greater capacity to use the Spanish language in a meaningful and functional way. The course emphasizes proficient communication skills, foundations of language learning, and understanding of cultures in the Spanish-speaking world. This third-year course continues the reinforcement of grammar concepts with a special focus on all the verb tenses (especially the subjunctive) along with cultural learning from the diverse world of Spanish-speakers, working towards expanding students' abilities at an intermediate level of proficiency. Students will review and extend their ability with such vocabulary as greetings, likes/dislikes, sports, opposites, family, body parts, clothing, food, weather, telling time, days, months, seasons, colors, numbers, shapes, professions, school nouns, places, telling directions, and feelings.

ARABIC 1 (1.0 Credit)

Prerequisite: None

This course is an introduction to the language and culture of the Arab world. You will learn to speak the language of this area of the world by exploring the culture and history of the people who speak it. By the end of this school year you will be able to read and write the alphabet, introduce yourself to another person, and have a basic conversation with a native speaker. You will also learn about and be able to discuss cultural differences between Arabic speakers and your own native culture and language.

ARABIC 2 (1.0 Credit)

Prerequisite: Arabic 1

This course will deepen your knowledge of the Arabic language and culture. Additionally we will focus on building your reading and writing skills, as well as gaining more confidence in speaking. By the end of the course you will be able to communicate at an intermediate proficiency level, and will have all of the linguistic skills to comfortably survive in the Arab world. We will also begin exploring the differences in the major Arabic dialects with an emphasis on the Levantine (Palestinian, Jordanian, Syrian, and Lebanese) and Egyptian dialects.

RUSSIAN 1

(1.0 Credit)

Prerequisite: None

This course is an introduction to the language and culture of Russia and the former Soviet Union. You will learn to speak the language of this area of the world by exploring the culture and history of the people who speak it. By the end of the school year you will be able to read and write the alphabet, introduce yourself to another person, and have a basic conversation with a native speaker. You will also learn about and be able to discuss cultural differences between Russian speakers and your own native culture and language.

RUSSIAN 2

(1.0 Credit)

Prerequisite: Russian 1

This course will deepen your knowledge of the Russian language and culture. Additionally we will focus on building your reading and writing skills, as well as gaining more confidence in speaking. By the end of the course you will be able to communicate at an intermediate proficiency level, and will have all of the linguistic skills to comfortably survive in the Russian speaking world. We will also focus on using authentic materials to gain greater cultural immersion and linguistic proficiency.

Elective World Language

FLEX (Foreign Language Exploration)

(0.50 Credit)

Prerequisite: None

FLEX begins the exploration that will build confidence for understanding the rich diversity of world languages. Come explore a broad introduction to linguistics and explore Spanish, French, German, Italian, Japanese, and others. Become familiar with these languages looking at culture, geography and basic vocabulary, such as greetings, numbers, colors, classroom nouns, as well as a short dialogue. Students will also create their own language exploration project on a language of their choice.

APPLIED TECHNOLOGY INTERNSHIP/WORK-BASED LEARNING (1.0 Credit Required)

INTERNSHIP

(1.0 Credit)

Prerequisites: 11th or 12th grade only

Internship, through Community Connected Learning (CCL), is an effort to make lifelong career development more meaningful and natural by linking the school site with the community. In cooperation with AMES, parents, business/industry, and the community, the student will experience: 1) real-world connections to academic and applied courses taught at AMES and future college setting; 2) preparation for educational advancement (college, etc.); 3) preparation for the professional world; and 4) development of life skills needed for success at work, home, and in the community. ALL students will be required to take the Internship Seminar/class during the school year, but may arrange to do their hours during the summer.

HEALTH EDUCATION (0.5 Credits Required)

HEALTH

(0.5 Credit Health)

Prerequisites: None

This course is designed to enhance knowledge, skills and the understanding necessary for students to make daily healthy choices to foster life-long healthy behaviors and attitudes. Students will explore the curriculum through a variety of instructional methods including guest speakers. Content areas include: healthy choices, human development and relationships, personality and self-esteem, stress management, mental disorders/suicide, nutrition and fitness, disease prevention and sexually transmitted diseases to include AIDS, substance (tobacco/alcohol/drugs) abuse prevention, safety and injury/violence prevention and consumer/community health.

PHYSICAL EDUCATION (1.5 Credits Required)

AIKIDO (0.5 Credit)

Prerequisites: None

Aikido is a Japanese self-defense system founded by Morie Ushiba following World War II. Techniques are based on sword and staff. Aikido movements are often called "grappling" and it is more similar to wrestling than other styles of karate. Punches and kicks and other offensive movements are not taught. Students are taught basic strikes so they can practice defense strategies against them. This course is a beginning Aikido class. Students are expected to learn basic vocabulary and terminology used in Aikido. Students also learn basic Aikido exercises called "aikitaiso". *Gi purchase or rental is required.*

WALKING FOR FITNESS (0.5 Credit)

Prerequisites: None

This course is designed for students to increase their fitness level through walking. Students will learn various walking techniques, health benefits of walking and fitness assessments. Students will participate in a low impact form of exercise that is life-long. Informational units in nutrition, managing stress, and the benefits of fitness will be covered through article reviews and reflections.

Lifetime Fitness Packet through AMES (0.5 Credit) Please see a counselor to discuss this option.

Athletics Participation (0.5 Credit) Please see a counselor to discuss this option.

FINANCIAL LITERACY (0.5 Credits Required)

FINANCIAL LITERACY (0.5 Credit)

Prerequisites: None

Financial Literacy will provide a better understanding of personal finance as students move into adulthood making more informed monetary decisions, realizing a greater potential personal wealth, and fostering a stronger state and national economy. Topics include: savings, investment options, wealth building, college savings, the dangers of debt, consumer awareness, credit bureaus, collections agencies, budgeting, bargain shopping, relating with money, career choices, taxes, insurance, real estate and mortgages.

**COLLEGE FORUM (9-11 Grades)
SENIOR PROJECT and PORTFOLIO
(1.0 Total Credit Required)**

COLLEGE FORUM

Grade 9-11 only

(.75 Credit by end of 11th Grade)

Prerequisites: None

College forum classes are held usually every Monday on A days from 9:00 am to 9:45 am. Students will receive credit for attending College Forum.

Goal 1: To inform students of news and events happening at AMES

Goal 2: To develop and maintain relationships between and among students and the adviser

Goal 3: To help student identify and develop the necessary attitudes, behaviors and skills to succeed in school, college, and life.

If a student has an early morning class with Cottonwood on A Days (A2), they will work with a counselor to receive the lesson. If a student misses a College Forum class, it is their responsibility to talk to their advisor to make it up.

Students will receive a grade of a "P" or and "I" for this class. If they receive and "I", it is their responsibility to make up this credit as it is needed for graduation.

Please see the counselors if you have any questions about College Forum classes.

SENIOR PROJECT AND PORTFOLIO

Grade 12 only

(.25 Credit)

Prerequisites: Senior

Students must prepare a digital portfolio that represents the student's growth while at AMES. Student will initiate the process of gathering materials for the portfolio in the freshman year. One piece of the Senior Portfolio is the Senior Project. The Senior Project is an individualized project, designed to prepare each student for a life of learning after AMES. The goal is for you to work through the process of raising a question or addressing a problem that you think is important, and then finding appropriate answers or solutions through inquiry, research, reflection and action.

**ELECTIVE CREDITS
(3.0 Credits Required)**

Courses taken through AMES that do not satisfy any of the above credit requirements will be placed as elective credit for students.

YEARBOOK

(1.0 Credit)

Prerequisites: None

Semester 1 - Basic Digital Photography - Students will acquire familiarity with principles and issues of basic digital photography. They will be introduced to the use and control of various types of digital cameras including digital SLR as well as compact digital cameras. Issues of camera control, image composition and image post production will be discussed and practiced. Post production techniques will be addressed through the use of Adobe products including Adobe Photoshop and Photoshop Elements. Students will also become familiar with strategies for purchasing their own camera equipment. Semester 2 - Digital File Preparation - This class introduces students to digital file preparation by using Adobe InDesign to create and publish the AMES Yearbook. Issues will include both hardware and software use, page design and layout, and final printing.

CHESS FUNDAMENTALS

(0.5 Credit)

Prerequisites: None

Chess Fundamentals is an elective course for beginning chess players. No experience with chess is necessary. Students will learn the rules of play, basic chess strategy, and algebraic notation, as well as good sporting behavior. Additionally, chess develops skills in concentration, visualization, and memory, and rewards careful decision making. There is much research to support chess in schools as a means to develop intellect and academic skills.

UGS 2001 – SOCIAL CONSTRUCTION OF RACE & GENDER I

(0.5 AMES Credit, 3.0 U of U Credit)

Prerequisite: Teacher recommendation

What is race? What is racism? How do television, film, popular music, social networking, and other forms of media shape how we think about race? How can we challenge racism by finding, creating, and sharing our own stories? In this course, students will explore these questions and others as they take part in critical analysis of popular media and create their own media through community-based action research. Media in this course is defined broadly to include visual art, poetry, music, and storytelling, as well as television, film and internet-based social networking.

UGS 2002 - SOCIAL CONSTRUCTION OF RACE & GENDER II

(0.5 AMES Credit, 3.0 U of U Credit)

Prerequisites: "C" or better in SOCIAL CONSTRUCTION OF RACE & GENDER I

What is race? How does it affect you? Is race something we just make up, or is there a real difference between people of different races? Do white people have a race? What are the ideas and theories that have influenced popular perceptions about race and justified racist laws and policies? This class will look at some of the "scientific" theories and popular beliefs about race and how they have been used in the past as well as how they play out today.

FILM PRODUCTION

(0.5 Credit)

Prerequisites: None

This course will investigate the basic principles of digital film production. Students will create a short film and, in the process, experience the various phases of production. These will include brainstorming, scripting, storyboarding, production and post-production. Students will investigate different film genera through the use of clips from notable films. They will analyze lighting techniques and practice some of these in the classroom environment. They will also capture audio and learn basic audio editing and multiplexing techniques.