



2018-2019

# Course Catalog

Science  
Technology  
Engineering  
Math



FELLOWSHIP  
CHRISTIAN SCHOOL



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COLOSSIANS 1: 9-12



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## Introduction

Fellowship Christian School has developed a **Center of Excellence** in **STEM** for families and students seeking a more technical secondary school experience. STEM is an acronym that stands for Science, Technology, Engineering, and Math. It has become a widely recognized term that reflects a nationwide academic initiative to enable the U.S. to remain the economic and technological leader in the global marketplace of the 21st century. A strong STEM program is foundational to our mission of “partnering to inspire academic curiosity, impeccable character, and Christian leadership.” Over the last several decades, STEM related products have changed the very fabric of our social and economic lives. Managing technological change is now a required skill for an educated citizenry. FCS considers it a privilege to help train up a new generation of STEM educated who live with purpose and lead with intent.



Each year we expand our course offerings to accommodate our growing STEM population and diverse student interests. Courses are numbered as follows:

- 10x Series – Introductory or exploratory courses.
- 11x Series – Design courses
- 12x Series – Engineering courses
- 13x Series – Computer and technology courses
- 14x Series – Advanced science courses and electives
- 15x Series – Advanced mathematics courses and electives
- 16x Series – Internships, teaching positions
- 17x Series – Senior level capstone and design courses.

All STEM courses are inherently hands-on. Course delivery formats include independent study, instructor led lectures and labs, and project based courses. Independent study enables a student to pursue a course under the supervision of a faculty member at their own pace. Our desire is that STEM students remain actively engaged in learning by doing rather than sitting. As such, project based learning is a hallmark of our STEM program.

## Current Course Offerings

### **STEM 100: Introduction to STEM**

**Target Grade(s):** 8

**Prerequisite:** None

**Corequisite:** None

**Term:** Seven Weeks

**Format:** Instructor Led – Project Based

**Description:**

Introduction to STEM is a middle school enrichment elective designed for students who wish to explore creation with Science, Technology, Engineering, and Math. It serves as primer for students considering our high school STEM program, as a motivator for students who haven't considered STEM, or as an avenue to experience science in a new and exciting way. The Introduction to STEM elective consists of four units focusing on transportation, renewable energy, space exploration, and robotics. These will be the technological frontiers of their generation. These units will consist of class discussions, individual research, and individual/small team projects. The following projects are planned; Solar powered race car, Wind generator, Estes rocket launch, and Kickstarter robot project.

### **STEM 110: Computer Aided Design I – Rapid Prototyping**

**Target Grade(s):** 9, 10

**Prerequisite:** None

**Corequisite:** Algebra 1

**Term:** One Semester

**Format:** Instructor Led – Project Based

**Description:**

This is the introductory course for all STEM students. It introduces students to the engineering design process, 3D design using Autodesk Fusion 360, and computer controlled manufacturing devices. It integrates rapid prototyping techniques using 3D printers, laser cutters, and CNC machines. Students engage in small team projects designing, prototyping, and constructing products. Students will gain an understanding of design thinking, prototyping methodologies, and construction materials. Students will gain foundational skills that will be used in other STEM courses.

## **STEM 111: Computer Aided Design II – Design**

**Target Grade(s):** 11, 12

**Prerequisite:** STEM 110 and STEM 111 (or equivalent competencies)

**Corequisite:** None

**Term:** One Semester

**Format:** Instructor Led – Project Based

### **Description:**

Design Thinking is the development of an idea from an initial thought to a final solution. It encompasses a multitude of methods and processes such as ideation, rapid visualization, rendered drawings, prototyping, problem solving, 3D modeling, and technical drawings. Students will utilize design thinking strategies and will be concerned with the entire life cycle of the design including environmental impacts during production, use, and final disposal. During this course, students will design a product or structure using Autodesk CAD applications. At the completion of the course students are encouraged to pursue an Autodesk User Certification. Study material and exam fees will apply.

## **STEM 112: Design Drawing**

**Target Grade(s):** 9, 10

**Prerequisite:** None

**Corequisite:** None

**Term:** One Semester

**Format:** Instructor Led – Project Based

### **Description:**

Design Drawing introduces students to the principles of design through sketching and drawing. This one semester course is geared toward developing artistic skills and computer skills to communicate ideas. The course first teaches specific hand drawing techniques used by product designers to convey ideas quickly, directly and convincingly. Then, vector and raster based digital drawing methodologies are introduced and practiced. Students will learn sketching, shading, and scaling skills, and will become familiar with Adobe Illustrator to communicate ideas, concepts, and product designs.

## **STEM 113: Introduction to Architectural Engineering**

**Target Grade(s):** 10 – 12

**Prerequisite:** STEM 110 and STEM 111 (or equivalent competencies)

**Corequisite:** Geometry

**Term:** One Semester

**Format:** Instructor Led – Project Based

### **Description:**

This course is designed to help students learn about the design of buildings, building layouts, structural and visual components, design processes, and architectural CAD software. Students will learn to use Autodesk's Revit 2018 to solve architectural design problems and create projects. Students will leave this course with knowledge that will help them proceed in more advanced architectural design programs. Students will gain a much greater appreciation and understanding of the buildings around them and the design elements involved.

## **STEM 114: Architectural Drawing and Design**

**Target Grade(s):** 10 – 12

**Prerequisite:** STEM 112 (or equivalent competencies)

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Project Based

### **Description:**

This course is designed to help students develop the drawing skills necessary for architectural conceptual design. It serves to marry art and architecture together into a design strategy which incorporates structure, form, and function into human activity. Students will gain an appreciation for architectural aesthetics and beauty while thinking empathically about its form and function.



## **STEM 120: Introduction to Mechanical Engineering**

**Target Grade(s):** 10 – 12

**Prerequisite:** None

**Corequisite:** Algebra 2

**Term:** One Semester

**Format:** Instructor Led – Lecture and Lab based

**Description:**

This course introduces students to the philosophy, vocabulary, skills, applications, and excitement of the engineering profession. Many engineering disciplines have their historical roots in mechanical engineering and its scope remains one of the broadest. As such, this course serves to prepare students for any engineering course of study. The course will provide students with a solid understanding of the engineering profession, a proficiency in pre-calculus engineering mathematics, and a disciplined approach to solving engineering type problems. It serves as the prerequisite for courses in Mechanical Systems and AP Physics C Mechanics.

## **STEM 121: Mechanical Systems**

**Target Grade(s):** 10 – 12

**Prerequisite:** STEM 120

**Corequisite:** Algebra 2

**Term:** One Semester

**Format:** Instructor Led – Project based

**Description:**

Students completing the Introduction to Mechanical Engineering course may elect this course as a follow-on engineering practicum. The course is structured around a single group project. The project utilizes many of the skills, knowledge, and attitudes gained from earlier engineering and design courses. Students will become familiar with our FAB Lab tools and resources and will develop various wood, metal, and composite material construction skills. It reinforces teamwork, creativity, and craftsmanship. The project for the 2017/2018 school year will be a single occupant hovercraft, capable of controlled flight up to 30 mph. Mechanical Systems is a required course for the Engineering STEM track.

## **STEM 122: Introduction to Electrical Engineering**

**Target Grade(s):** 11, 12

**Prerequisite:** None

**Corequisite:** Pre-Calculus

**Term:** One Semester

**Format:** Instructor Led – Lecture and Lab based

### **Description:**

Introduction to Electrical Engineering is a one semester course which introduces students to the theory, vocabulary, skills, and applications of electrical engineering. The course will provide students with a solid understanding of electricity, direct current circuits, alternating current circuits, and digital signal processing. Students will study electrostatics, electrodynamics, and electromagnetism and will become proficient in analyzing DC and AC circuits. Some basic differential calculus and complex number mathematics will be taught as required. It serves as the prerequisite to the Digital Systems course.

## **STEM 123: Digital Systems**

**Target Grade(s):** 11, 12

**Prerequisite:** STEM 122

**Corequisite:** Pre-Calculus

**Term:** One Semester

**Format:** Instructor Led – Project based

### **Description:**

Students completing the Introduction to Electrical Engineering course may elect this course as a follow-on engineering practicum. The course is structured around small individual projects and one large class project. The projects utilize many of the skills, knowledge, and attitudes gained from earlier engineering, design, and programming courses. Students will also become familiar with our FAB Lab tools and resources and will develop various construction and electrical assembly skills. It reinforces teamwork, creativity, and craftsmanship. Digital Systems is a required course for the Engineering and Digital Science STEM tracks.

## **STEM 130: Python Programming**

**Target Grade(s):** 9 – 12

**Prerequisite:** Algebra 1

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Project based

**Description:**

This course is an introduction to computational problem solving. It is designed to help students apply computational methodologies on a computer, and to guide the process of deducing information in a computational manner. Students will learn and utilize the Python programming language. They will become familiar with basic algorithmic techniques for solving common problems, as well as simulation and statistical methodologies for modeling complex systems. It helps prepare students for computational proficiency in any field of study. The course is aimed at students with little or no prior programming experience but a desire to understand computational approaches to problem solving. It requires some mathematical understanding through Algebra 1, but more importantly, it requires a logical aptitude or willingness to engage in complex problem solving.

## **STEM 131: AP Computer Science A**

**Target Grade(s):** 9 – 12

**Prerequisite:** Algebra 1

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Project based

**Description:**

AP Computer Science A is a two-semester course that is the equivalent to a first-semester college introductory course in Computer Science. It teaches object-oriented programming methodology using Java. The course teaches students how to design, code, debug, and implement practical programs. Design includes ideas such as well-documented, reusable, and adaptable code. Coding concentrates on higher level skills involving problem solving and algorithmic development. This course is targeted toward students who are considering taking college courses in such areas as Computer Science, Information Technology, general Science, or Engineering. Students will write OOP (object-oriented) programs utilizing classes, objects, methods, class inheritance, and polymorphism using the standard Java library classes from the AP Java subset. The course includes a minimum of 20 hours of hands-on lab experiences integrated throughout the year. Students will be expected to take the AP Computer Science A Exam at the end of the year.

## **STEM 132: CompTIA A+ Certification**

**Target Grade(s):** 11 – 12

**Prerequisite:** STEM 130 or STEM 131

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led

### **Description:**

A+ (A Plus) is an entry-level computer certification for people going into Information Technology. The course is designed to gain competency in installing, maintaining, customizing, and operating personal computers. The A+ certification is sponsored by the Computing Technology Industry Association (CompTIA). CompTIA is a large trade group, founded in 1982 and made up of resellers, distributors, and manufacturers. It is a worldwide recognized organization which provides students with the knowledge and skills necessary to support a wide range of computer technologies. Students who earn an A+ certification are well ahead of their peers within any STEM related pursuit.

## **STEM 140: AP Biology**

**Target Grade(s):** 12

**Prerequisite:** Honors Biology

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Lecture and Lab based

### **Description:**

AP Biology is an introductory college-level biology course. Students cultivate their understanding of biology through inquiry-based investigations as they explore the following topics: the theory of evolution, cellular processes — energy and communication, genetics, information transfer, ecology, and interactions. This course requires that 25 percent of the instructional time will be spent in hands-on laboratory work, with an emphasis on inquiry based investigations that provide students with opportunities to apply the science practices. All students are required to take the AP Biology exam in May.

## **STEM 141: AP Chemistry**

**Target Grade(s):** 12

**Prerequisite:** Honors Chemistry

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Lecture and Lab based

**Description:**

The AP Chemistry course provides students with a college-level foundation to support future advanced course work in chemistry. Students cultivate their understanding of chemistry through inquiry-based investigations, as they explore topics such as: atomic structure, intermolecular forces and bonding, chemical reactions, kinetics, thermodynamics, and equilibrium. This course requires that 25 percent of the instructional time engages students in lab investigations. This includes a minimum of 16 hands-on labs (at least six of which are inquiry based). All students are required to take the AP Chemistry exam in May.

## **STEM 142: AP Physics C Mechanics**

**Target Grade(s):** 12

**Prerequisite:** Honors Physics, Conceptual Physics, or STEM 120

**Corequisite:** Calculus

**Term:** Full Year

**Format:** Instructor Led – Lecture and Lab based

**Description:**

AP<sup>®</sup> Physics C is a national calculus-based course in physics. This course is equivalent to the pre-engineering introductory physics course for university students. The emphasis is on understanding the concepts and skills and using the concepts and formulae to solve problems. Laboratory work will be an integral part of this course. All students in this class must have taken, or are concurrently enrolled in, a first-year calculus course. AP<sup>®</sup> Physics C Mechanics emphasizes Newtonian mechanics, from simple kinematics through complex oscillatory motion. This class meets every week day for approximately 50 minutes. One day per week will be devoted to lab activities which will represent 20% of total class time. All students are required to take the AP Physics C – Mechanics exam in May.

## **STEM 150: AP Calculus AB**

**Target Grade(s):** 11, 12

**Prerequisite:** Honors Pre-Calculus

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Lecture based

### **Description:**

AP Calculus AB is roughly equivalent to a first semester college calculus course devoted to topics in differential and integral calculus. The AP course covers topics in these areas, including concepts and skills of limits, derivatives, definite integrals, and the Fundamental Theorem of Calculus. The course teaches students to approach calculus concepts and problems when they are represented graphically, numerically, analytically, and verbally, and to make connections amongst these representations. Students learn how to use technology to help solve problems, experiment, interpret results, and support conclusions. All students are required to take the AP Calculus exam in May.

## **STEM 151: AP Calculus BC**

**Target Grade(s):** 12

**Prerequisite:** STEM 150

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Lecture based

### **Description:**

AP Calculus BC is roughly equivalent to both first and second semester college calculus courses. It extends the content learned in AB to different types of equations (polar, parametric, vector-valued) and new topics (such as Euler's method, integration by parts, partial fraction decomposition, and improper integrals), and introduces the topic of sequences and series. The AP course covers topics in differential and integral calculus, including concepts and skills of limits, derivatives, definite integrals, the Fundamental Theorem of Calculus, and series. The course teaches students to approach calculus concepts and problems when they are represented graphically, numerically, analytically, and verbally, and to make connections amongst these representations. Students learn how to use technology to help solve problems, experiment, interpret results, and support conclusions. All students are required to take the AP Calculus exam in May.

## **STEM 152: AP Statistics**

**Target Grade(s):** 11, 12

**Prerequisite:** Honors Pre-Calculus

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Lecture based

**Description:**

The AP Statistics course is equivalent to a one-semester, introductory, non-calculus-based college course in statistics. The course introduces students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. There are four themes in the AP Statistics course: exploring data, sampling and experimentation, anticipating patterns, and statistical inference. Students use technology, investigations, problem solving, and writing as they build conceptual understanding. All students are required to take the AP Statistics exam in May.

## **STEM 160: STEM Lab Assistant**

**Target Grade(s):** 10 – 12

**Prerequisite:** None

**Corequisite:** None

**Term:** One Semester

**Format:** Independent Study

**Description:**

Students selected as STEM Lab Assistants will work under the Director of STEM to help support the overall STEM program. Responsibilities will include project/lab management, communication, and instructional support. STEM Lab Assistants will be assigned to a particular teacher within their Pathway. They will be responsible for supporting all lab activities, including design, setup, execution, and cleanup. They will also provide instructional support such as grading and tutoring. Students must first gain approval from the Director of STEM prior to enrollment.

## **STEM 161: Middle School Robotics Instructor**

**Target Grade(s):** 11, 12

**Prerequisite:** At least one year experience on a competitive VEX robotics team.

**Corequisite:** None

**Term:** One Semester

**Format:** Independent Study

### **Description:**

Students selected as Robotics Instructors will work under a faculty member to support the overall middle school robotics program. Student instructors will assist younger students in designing, constructing, and testing their robots. They will serve as team mentors guiding middle school students as they acquire more advanced robotic skills. They will help support overall class management, equipment maintenance, construction activities, and competitions. Student instructors will become certified using metal working shop equipment as necessary to support the VEX build sessions. They will also train and supervise younger students in the proper use of hand tools. Students must be selected for an instructor position through the STEM department prior to enrollment.

## **STEM 162: IT Internship**

**Target Grade(s):** 10 – 12

**Prerequisite:** None

**Corequisite:** None

**Term:** One Semester

**Format:** Independent Study

### **Description:**

IT Interns will work under the Director of Information Technology during their scheduled period. Interns will receive training to staff the help desk, perform basic computer repair, and assist in the daily management of the network infrastructure. During the internship, students will pursue a CompTIA certification in IT Fundamentals. The CompTIA IT Fundamentals exam covers foundational IT concepts including identifying and explaining computer components, installing software, establishing network connectivity and preventing security risks. An examination fee of \$115 will apply.



## **STEM 163: STEM Internship**

**Target Grade(s):** 12

**Prerequisite:** Completion of a STEM pathway program through the junior year.

**Corequisite:** None

**Term:** One Semester

**Format:** Independent Study

**Description:**

The internship program provides students with an opportunity to gain real-world experience working within their field of study. Students will be paired with an internal/external organization that best represents their STEM pathway and collegiate goals. Students must work a minimum of 80 hours and then submit a final report detailing their experience. Applications for student internships usually begin in the Spring of their Junior year. Internships are normally scheduled during a student's senior year, but may occur in the summer prior. STEM internships provide a valuable capstone learning experience and are highly respected by college admission departments.

## **STEM 170: Advanced Research and Design**

**Target Grade(s):** 12

**Prerequisite:** Completion of a STEM pathway program through the junior year.

**Corequisite:** None

**Term:** Full Year

**Format:** Independent Study

**Description:**

Advanced Research and Design is a culminating course offered to STEM students in their senior year. Students will work individually, or in small teams, to develop a product or solution for a school, community, or ministry need. Students will be assigned a faculty advisor who will monitor and support the project. During the first semester, students will identify the problem or need, develop a design solution, and create a proposal presentation for their faculty advisor. Once approved, students will execute their design either producing a prototype for further analysis or a finished product/solution. The Capstone Design Project reinforces teaming, organizational, and communication skills, while utilizing the skills, knowledge, and attitudes gained in previous STEM courses.

## **STEM 171: STEM Capstone Course**

**Target Grade(s):** 12

**Prerequisite:** Completion of a specific STEM program of study through the 11th grade.

**Corequisite:** None

**Term:** Full Year

**Format:** Varies

### **Description:**

The STEM Capstone Course is a culminating course offered to STEM students in their senior year. Students can choose from a variety of options designed either to acquire advanced knowledge or apply previous knowledge. Each option helps prepare students for college entry by enhancing their Pathway expertise and college resume. Students may choose from the following options:

- Take an additional Pathway related AP or Dual Enrollment Course
- Take a CompTIA A+ Certification Course (STEM 132)
- Become a STEM Lab Assistant (STEM 160)
- Become a Middle School Robotics Instructor (STEM 161)
- Engage in an independent research design project (STEM 170 )
- Participate in a Pathway related Internship during school (STEM 162 or 163)

## Future Course Offerings

### STEM 133: Web Design

**Target Grade(s):** 11, 12

**Prerequisite:** STEM 130 or STEM 131

**Corequisite:** None

**Term:** One Semester

**Format:** Instructor Led – Project based

**Description:**

This is a course in web site design. Students will become comfortable creating, coding and posting HTML, JavaScript, and CSS files to the Internet. They will gain a historical understanding of the web's evolution and understand key design standards and guidelines. Students will acquire a foundational knowledge of website creation and apply it to the planning, design and development of their own web site as a final project.

### STEM 143: AP Physics C Electricity and Magnetism

**Target Grade(s):** 12

**Prerequisite:** Honors Physics, Conceptual Physics, or STEM 122

**Corequisite:** Calculus

**Term:** Full Year

**Format:** Instructor Led – Lecture and Lab based

**Description:**

AP<sup>®</sup> Physics C is a national calculus-based course in physics. This course is equivalent to the pre-engineering introductory physics course for university students. The emphasis is on understanding the concepts and skills and using the concepts and formulae to solve problems. Laboratory work will be an integral part of this course. All students in this class must have taken, or are concurrently enrolled in, a first-year calculus course. APPC Electricity and Magnetism emphasizes electromagnetic theory, from simple electrostatics through Maxwell's four laws of electromagnetism. This class meets every week day for approximately 50 minutes. One day per week will be devoted to lab activities which will represent 20% of total class time. Other than labs, class time is typically spent in interactive lecture-discussions, classwork sessions, and tests. All students are required to take the AP Physics C – Electricity and Magnetism exam in May.

## **STEM 144: Modern Physics**

**Target Grade(s):** 12

**Prerequisite:** Honors Physics, AP Calculus AB

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Lecture based

### **Description:**

The course is divided into four sections: Section 1: A modern approach to classical physics; Section 2: Quantum Mechanics; Section 3: Relativity; Section 4: Particle Physics. The material is presented in both a qualitative and quantitative manner. Although the fundamental mathematics will be presented, computational proficiency will not be required in cases where the math exceeds basic calculus operations. In this sense, much of the mathematical formulations of modern physics will be presented in the manner of a foreign language. The goal will be to acquire a deep understanding of the mathematical principles rather than a computational proficiency of upper college level mathematics. Additionally, matters of faith and science will be discussed. The class will explore various world-view interpretations arising out of modern physics and contrast them with Biblical Christianity.

## **STEM 145: AP Environmental Science**

**Target Grade(s):** 11, 12

**Prerequisite:** Biology

**Corequisite:** None

**Term:** Full Year

**Format:** Instructor Led – Lecture and Lab based

### **Description:**

The goal of the AP Environmental Science course is to provide students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, to evaluate the relative risks associated with these problems, and to examine alternative solutions for resolving and/or preventing them. All students are required to take the AP Environmental Science exam in May.

## **STEM 153: Engineering Mathematics**

**Target Grade(s):** 12

**Prerequisite:** Pre-Calculus

**Corequisite:** Calculus

**Term:** Full Year

**Format:** Instructor Led – Lecture based

**Description:**

Engineering Mathematics is for students who wish to sharpen their mathematical skills or prepare for math intensive degree programs in college. The course is split into the following four, 9 week units.

- Unit 1 – Linear Algebra
- Unit 2 – Vector Algebra
- Unit 3 – Complex Variables
- Unit 4 – Finite Differencing

In each unit, students are introduced to the terminology, conventions, skill sets, and applications for the topic. They will gain a deeper understanding and proficiency in using vectors, matrices, imaginary numbers, and numeric modeling. This course is well suited for students pursuing engineering or mathematical degree programs in college. The final unit, Finite Differencing, will introduce students to solving ordinary differential equations using Taylor series expansions. It will use Microsoft Excel as a computational tool.