STEM
FELLOWSHIP CHRISTIAN SCHOOL

2020-2021

Course Catalog

Science
Technology
Engineering
Math

Mechanical Systems Course Project
Star Wars Themed Hovercraft
(2017-2018)

FELLOWSHIP CHRISTIAN SCHOOL
EST. 1986
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 grounded in biblical truth." 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 people 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 – Internships and teaching positions
- 15x 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 engage 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 (CAD) 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 (CAD) 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:

Engineering design 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 develop advanced CAD skills relevant to their chosen pathway. Architectural students will become proficient with Audodesk Revit and Engineering/Industrial Design students will continue to sharpen their Autodesk Fusion 360 skills. 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 and structures. Standard building components such as beams, columns, arches, domes, trusses, tension wires, and thin shells are introduced and analyzed. Mathematical relationships are introduced and load following techniques are developed. Students will investigate the properties of materials and the load carrying capacities of various building components through hands-on investigations and laboratories. Students will gain a familiarity with structural engineering and material science.

STEM 114: Introduction to Architectural Design

Target Grade(s): 10 – 12

Prerequisite: STEM 112 (or equivalent competencies)

Corequisite: None

Term: One Semester

Format: Instructor Led – Collaborative learning

Description:

Architecture engages a culture's deepest social values and expresses them in a material and aesthetic form. This course is designed to help students learn about the design of structures, building layouts, structural/visual components, and design processes. Students will learn to "read" architecture as a cultural expression as well as a technical achievement. They will study the theoretical, philosophical, and historical aspects of architecture. Students will gain a much greater appreciation and understanding of the buildings around them and will leave the course with knowledge that will help them proceed in post-secondary architectural design programs.

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 a prerequisite for AP Physics C Mechanics.

STEM 121: Mechanical Systems

Target Grade(s): 10 – 12

Prerequisite: None

Corequisite: None

Term: One Semester

Format: Instructor Led – Project based

Description:

The course is structured around a single group project or several small team projects. Students will become familiar with our FAB Lab tools and resources and will develop various wood, metal, and composite material construction skills. The course reinforces teamwork, creativity, and craftsmanship. Students will be involved in the creative process and then see their creation come to life. The course is untraditional in that no written assessments are given. Student performance is evaluated solely on their contribution to the team and the project.

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:

The course is structured around a single group project or several small team projects. Students will become familiar with our FAB Lab tools and resources and will develop various construction and electrical assembly skills. The course reinforces teamwork, creativity, and craftsmanship. Students will be involved in the creative process and then see their creation come to life. The course is untraditional in that no written assessments are given. Student performance is evaluated solely on their contribution to the team and the project.

STEM 124: Introduction to Aeronautical Engineering

Target Grade(s): 11, 12

Prerequisite: None

Corequisite: Pre-Calculus

Term: One Semester

Format: Instructor Led – Lecture based

Description:

Introduction to Aeronautical Engineering is a one semester course which introduces students to the theory, vocabulary, skills, and applications of aeronautical engineering. The course will provide students with a solid understanding of fluid dynamics, airfoil and wing theory, stability and control, and aircraft performance. Students will finish the course by designing a model airplane.

STEM 125: Aircraft Design

Target Grade(s): 11, 12

Prerequisite: STEM 124

Corequisite: Pre-Calculus

Term: One Semester

Format: Instructor Led – Project based

Description:

Students completing the Introduction to Aerodynamics course may elect this course as a follow-on engineering practicum. The course is structured around building the model airplane designed in the previous course. Students will learn how to use several software design tools and learn how to create foam composite structures and carbon fiber reinforcements. Students will learn the concepts of Radio Control systems and install the necessary components to fly their aircraft.

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 – Project Based

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: 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 141: 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 142: 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 143: 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 150: 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.

Future Course Offerings

STEM 126: 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.

STEM 133: AP Computer Science Principles

Target Grade(s): 11 – 12

Prerequisite: None

Corequisite: None

Term: Full Year

Format: Instructor Led – Project based

Description:

Whether it's 3-D animation, engineering, music, app development, medicine, visual design, robotics, or political analysis, computer science is the engine that powers the technology, productivity, and innovation that drive the world. Computer science experience has become imperative for students' success in the workforce of tomorrow. AP Computer Science Principles offers a multidisciplinary approach to teaching the underlying principles of computation. The course will introduce students to the creative aspects of programming, abstractions, algorithms, large data sets, the Internet, cybersecurity concerns, and computing impacts. AP Computer Science Principles also gives students the opportunity to use current technologies to create computational artifacts for both self-expression and problem solving. Together, these aspects of the course make up a rigorous and rich curriculum that aims to broaden participation in computer science.

STEM 134: 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.