2026-2027 COURSE SYLLABUS

PRINCIPLES OF ENGINEERING

ANALYZE • BUILD • TEST • OPTIMIZE

Grade 10 | Full-Year Engineering Course

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CLASSROOMS	COURSE HUB	EMAIL
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Course Description

Principles of Engineering is a full-year, aerospace-focused course that applies physics, mathematics, computing, and design to mechanisms, structures, materials, circuits, robotics, controls, fluid power, statistics, and motion. Through hands-on investigations, students build and test systems, collect data, and explain performance.

The course emphasizes evidence-based systems thinking. Students create VEX mechanisms, load-test structures, program autonomous rover missions, integrate ground-support systems, and complete an aerospace rover capstone combining mechanical, structural, electrical, control, programming, documentation, teamwork, and presentation skills.

Course Learning Outcomes

Students will develop skills across four connected areas of engineering practice.

Mechanical Systems and Energy

- Analyze simple machines, gears, pulleys, work, power, efficiency, energy, circuits, and motors.
- Design, build, and test VEX mechanisms using calculations and performance data.

Structures and Materials

- Use free body diagrams, vectors, moments, equilibrium, trusses, and centroids to explain loads.
- Compare materials and design lightweight structures using mass, stiffness, stress-strain behavior, and load-test evidence.

Controls, Robotics, and Fluid Power

- Develop algorithms, flowcharts, and code for autonomous rover and ground-support systems.
- Integrate sensors, feedback, motors, servos, actuators, VEX components, and fluid-power devices.

Data and Professional Practice

- Plan repeatable tests and analyze graphs, statistics, reliability, kinematics, and motion data.
- Document evidence, work safely, integrate subsystems, and defend final design decisions.

COURSE SEQUENCE

Units of Study

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0	**Engineering Readiness & Aerospace Systems Foundations**	Course orientation, binder and engineering notebook setup, safety, PPE, certifications, Fusion refreshers, VEX and rover readiness, systems thinking, and an aerospace readiness mini-challenge.
1	**Mechanisms for Space Missions**	Simple machines, mechanical advantage, gears, pulleys, chain drives, VEX construction, work, power, efficiency, energy sources, circuits, motors, and a rover mechanism challenge.
2	**Aerospace Structures & Materials**	Loads, free body diagrams, vectors, moments, equilibrium, trusses, centroids, stiffness, material properties, density, stress-strain behavior, load testing, and a payload support structure.
3	**Autonomous Aerospace Systems**	Control logic, algorithms, sensors, feedback, rover programming, VEX components, actuators, fluid power, Pascal's Law, mission testing, and ground-support system integration.
4	**Mission Performance: Statistics, Kinematics & Test Data**	Variables, trial design, probability, distributions, descriptive statistics, variation, graphs, distance, velocity, acceleration, free fall, projectile motion, calibration, and performance analysis.
5	**Aerospace Rover Systems Capstone: Design, Test & Defend**	Stakeholders, requirements, system architecture, mechanisms, structures, controls, CAD, fabrication, integration, testing, failure analysis, iteration, final documentation, demonstration, and design defense.

Major Course Projects

01 Aerospace readiness mini-challenge	**02 VEX rover mechanisms challenge**
03 Aerospace payload support structure	**04 Autonomous rover mission**
05 VEX ground-support and fluid-power system	**06 Mission performance data investigation**
07 Integrated aerospace rover systems capstone and design review	

ASSESSMENT AND GRADING

How Progress Is Measured

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Grading System

Grades are calculated using a total-points system. A student's course grade is determined by dividing the total number of points earned by the total number of points available. The school grading scale will be used to convert the resulting percentage into a letter grade.

How the Grade Is Calculated

Points earned divided by points available equals the course percentage. Assignment point values reflect the scope, complexity, and evidence required.

What May Be Graded

- Mechanism, structure, robotics, fluid-power, and integrated systems projects
- Calculations, free body diagrams, flowcharts, code, circuit evidence, and system models
- Engineering notebook and binder documentation
- Labs, investigations, repeated trials, graphs, statistics, and motion analysis
- Skill checks, quizzes, certifications, and assessments
- Presentations, design reviews, reflections, and portfolios
- Individual contributions to team engineering work

Point values may vary slightly from one assignment to the next, but below you will find the general point structure for various assignment types.

Evidence Type	Typical Range	Examples
Daily readiness or exit check	5 points	Course procedures, progress checks, and short reflections.
Daily lesson evidence	10 points	Short analyses, notebook entries, interactive checks, and focused practice.
Technical lesson deliverable	15 points	Calculations, diagrams, code evidence, circuit work, CAD evidence, measurements, and documented engineering work.
Extended two-day deliverable	20-25 points total	Day 1 progress checkpoint plus completed Day 2 evidence.
Checkpoint quiz	20 points	Six-question printable checkpoint quiz.
Unit test	50 points	Comprehensive written unit assessment.
Presentation or design review	25-40 points	Rubric-scored communication, evidence, and design defense.

Extra Credit

ENGINEERING CHALLENGES ONLY

Extra-credit opportunities are limited to optional Engineering Challenges. Each unit will include approximately 3-5 challenges, and each successfully completed challenge is worth 10 extra-credit points. Challenges must meet all stated requirements, be submitted by the deadline, and represent the student's own work.

Late Work, Revisions, and Retakes

- Late work may be submitted until the end of the corresponding unit.
- Students may revise eligible design work after receiving feedback. Revised work must demonstrate meaningful improvement rather than simple resubmission.
- Quizzes and equipment certifications may be retaken after the student completes additional preparation or corrective work.
- Major projects may include required checkpoints that must be completed before a student is permitted to fabricate, test, or advance to the next stage.
- Work submitted after a unit closes may require an approved exception.

MATERIALS AND DOCUMENTATION

What Students Need

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Required Materials

• A 1.5-inch or 2-inch three-ring binder	• Loose-leaf lined paper
• Loose-leaf graph paper	• Six binder dividers
• Pencils and erasers	• Pens
• Colored pencils	• Fine-tip permanent markers, such as Sharpies
• A wired or wireless (not Bluetooth) computer mouse	• Headphones
• School-issued computer and charger	• Closed-toe shoes on fabrication days

Optional Materials

Personal safety glasses and digital calipers are recommended for students who expect to continue in engineering, but neither item is required.

SAFETY GLASSES

Safety glasses will be provided for all students. Students may purchase their own pair for a more comfortable fit, provided the glasses meet classroom safety standards. Students who wear prescription eyeglasses must still wear safety glasses over them because regular eyeglasses may not be impact resistant and do not provide adequate side protection.

- Safety glasses can be purchased for around $5 at any hardware store (Home Depot, Lowes, Ace Hardware, Harbor Freight, Walmart) or on Amazon.

Digital Calipers

Classroom calipers are available for all students in the classroom. Students who wish to work on projects at home, or those who will take additional engineering courses in future school years are recommended to have their own personal set of digital calipers.

- Calipers can be purchased for around $10 at Harbor Freight or on Amazon.

Binder and Engineering Notebook

The binder is each student's engineering notebook and course portfolio. Six dividers organize course information, notes and calculations, assignments, project records, and assessments. Required labels and setup procedures will be provided at the beginning of the course. Students may store binders in the classroom but remain responsible for organization and taking them home when needed.

SAFETY AND DAILY PRACTICE

Safe Work Is Professional Work

POE

FabLab Safety

Safety is a condition of participation in all fabrication, robotics, electrical, fluid-power, prototyping, and laboratory activities. Students must complete required safety instruction and equipment certifications before using tools, machines, VEX systems, or specialized equipment.

- Wear required personal protective equipment whenever directed.
- Use only the tools, machines, materials, and settings approved by the instructor.
- Inspect the work area and equipment before use and immediately report damaged tools, injuries, spills, or unsafe conditions.
- Keep hands, hair, jewelry, loose clothing, cords, and personal items clear of moving equipment and work zones.
- Follow all startup, shutdown, ventilation, cleanup, and material-handling procedures.
- Never bypass guards, interlocks, emergency stops, supervision requirements, or other safety systems.
- Horseplay, distracting others during tool use, and unauthorized experimentation are prohibited.
- Unsafe behavior may result in removal from an activity and temporary or permanent loss of equipment privileges.

STOP-WORK RESPONSIBILITY

Every student has the responsibility to stop and ask for help whenever a tool, material, setup, instruction, or situation appears unsafe or unclear.

Daily Classroom Expectations

- Arrive prepared with the required computer, charger, mouse, headphones, and course materials.
- Begin the posted entry task and review the daily agenda without waiting for individual reminders.
- Use class time productively and remain engaged in assigned engineering work.
- Treat classmates, ideas, equipment, projects, and shared workspaces with respect.
- Return tools and materials to their assigned locations and leave the work area cleaner than it was found.
- Follow digital citizenship expectations when using school devices, cloud storage, CAD software, VEXcode, simulations, code, and online resources.
- Ask questions, seek feedback, and communicate problems early.

Attendance and Missed Work

Because many course activities involve demonstrations, team decisions, shared equipment, VEX systems, fabrication, programming, testing, or data collection, regular attendance is important. Students who are absent are responsible for checking Google Classroom, reviewing posted resources, and communicating with the instructor about missed work. Some laboratory, fabrication, programming, testing, or presentation activities may require an alternate assignment or a scheduled make-up opportunity.

COLLABORATION AND INTEGRITY

Own Your Work

POE

Collaboration and Individual Accountability

Engineering is collaborative, and students will frequently work in teams. Teamwork does not remove individual responsibility. Each student is expected to:

Individual Responsibility

- Maintain an individual engineering notebook and understand the team's mechanism, structure, control logic, data, and system design.
- Complete assigned responsibilities and contribute to planning, calculations, construction, programming, fabrication, testing, documentation, and cleanup.
- Identify individual contributions during presentations, reflections, and project reviews.

Professional Teamwork

- Communicate respectfully, listen to alternative ideas, and resolve disagreements using evidence.
- Ask for help when a team member is unable or unwilling to participate safely or productively.
- Support the team without completing another student's individual responsibilities.

Artificial Intelligence

Approved artificial intelligence tools may support learning, but they may not replace the student's engineering thinking. Unless a specific assignment states otherwise, the following expectations apply:

AI May Support

- Brainstorming and generating questions
- Receiving feedback
- Troubleshooting code, calculations, circuits, CAD, or engineering processes
- Improving organization and clarity
- Exploring possible approaches

AI May Not Replace

- The student's own engineering thinking
- Work the student cannot explain or defend
- Research, calculations, code, testing data, or notebook entries
- Assessments when AI use is prohibited
- Accurate disclosure of meaningful AI assistance

THE EXPLANATION TEST

A student must be able to explain, defend, revise, and safely apply anything submitted with AI assistance. Students remain responsible for accuracy, safety, originality, and suitability.

Academic Integrity

All submitted work must accurately represent the student's own knowledge and contributions. Copying CAD files, code, flowcharts, circuit work, calculations, reports, notebook entries, data, structural analyses, or design documentation without permission and appropriate attribution is not acceptable. Collaboration is encouraged when assigned, but collaboration does not mean submitting identical individual work. Violations of the Cornerstone Charter Academy policies on academic integrity may result in a zero on the assignment or further administrative penalties.

COMMUNICATION AND SUPPORT

Where to Find Help

POE

Course Resources

Google Classroom
Official location for assignments, due dates, announcements, submissions, and feedback.

LockwoodSTEM.org
Course hub for lessons, downloads, technical references, certifications, simulations, programming resources, and project information.

Teacher Support
Jonathan Lockwood | D101, D102, D103 | After school until 4:00 PM | jlockwood@cornerstonecharter.com

Student Support and Accommodations

Students with documented accommodations will receive support in accordance with their educational plan. Students should communicate with the instructor when an accommodation, accessibility need, temporary injury, or other concern may affect safe participation, fabrication, programming, testing, presentation, or completion of course work.

Class Amazon Wishlist

Families who would like to support the course may use the QR code below to view the class Amazon Wishlist. Contributions are optional and always appreciated, but they are never expected.

Optional Classroom Support

Wishlist items may include consumable materials, organization supplies, tools, replacement parts, and project resources that help expand student opportunities.

amazon.com/hz/wishlist/ls/2PEX0S3EFCNRY

SCAN TO VIEW

COMMUNICATION MATTERS
Students are encouraged to communicate early when they need clarification, additional help, or support completing a course requirement.

STUDENT AND FAMILY ACKNOWLEDGMENT

Review, Sign, and Return

POE

Please review the course syllabus together. Return this signed page by the date posted in Google Classroom. The complete syllabus should remain in the student's course binder or be retained digitally for future reference.

By Signing Below, We Acknowledge That We Have Reviewed and Understand

- Course goals, learning outcomes, units, and major projects
- Required materials and binder expectations
- Grading, late-work, revision, retake, and extra-credit policies
- FabLab safety rules, PPE requirements, and equipment privileges
- Collaboration, individual accountability, and academic integrity expectations
- Artificial intelligence expectations and disclosure responsibilities
- Communication platforms and procedures for requesting support

Student Information

_____ _____

Student printed name | Class period

_____ _____

Student signature | Date

Parent / Guardian Information

_____ _____

Parent/guardian printed name | Preferred phone

_____ _____

Parent/guardian signature | Date

_____ _____

Preferred email address | Best contact time (optional)

Optional Information for the Instructor

_____

_____

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THANK YOU

Thank you for supporting a safe, creative, analytical, and rigorous year of engineering.