2026-2027 COURSE SYLLABUS

INTRODUCTION TO ENGINEERING DESIGN

DESIGN • BUILD • TEST • IMPROVE

Grade 9 | Full-Year Engineering Course

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CLASSROOMS	COURSE HUB	EMAIL
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Course Description

Introduction to Engineering Design introduces students to the practices, tools, and habits of mind used by engineers. Through an aerospace-focused sequence of design challenges, students will identify problems, develop and compare ideas, create technical documentation, model parts and assemblies in CAD, build physical prototypes, collect and analyze data, test solutions, and communicate evidence-based design decisions.

The course emphasizes iterative problem-solving. Students are expected to learn from unsuccessful ideas, use feedback and testing to improve their work, and document how their designs develop over time. By the end of the course, students will complete a comprehensive capstone that integrates design, technical communication, fabrication, testing, teamwork, and presentation skills.

Course Learning Outcomes

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

Engineering Design

- Define problems by identifying user needs, criteria, constraints, and measurable requirements.
- Generate, compare, select, test, and improve design concepts using evidence.
- Use an iterative process rather than treating the first idea as the final solution.

Technical Communication

- Maintain an organized engineering notebook and course portfolio.
- Create sketches, drawings, exploded views, bills of materials, design reviews, and presentations.
- Explain design decisions using appropriate vocabulary, calculations, data, and evidence.

CAD and Prototyping

- Create parametric parts and assemblies using computer-aided design software.
- Apply dimensions, constraints, tolerances, design intent, and manufacturing considerations.
- Prepare models for fabrication and evaluate prototypes for fit, function, and quality.

Systems and Professional Practice

- Apply concepts involving materials, mechanisms, motion, friction, data, circuits, and electromechanical systems.
- Work safely and responsibly in the FabLab and complete required equipment certifications.
- Consider user needs, ethics, sustainability, life cycle, and stakeholder priorities.

COURSE SEQUENCE

Units of Study

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0	**Engineering Foundations and FabLab Readiness**	Course orientation, binder and engineering notebook setup, safety, PPE, tool readiness, and the Rocket Launch Pad Design Challenge.
1	**Engineering Documentation and Product Improvement**	Sketching, measurement, tolerances, fasteners, adhesives, assemblies, exploded views, bills of materials, and rocket redesign.
2	**Parametric CAD and Part Design**	CAD sketches, constraints, dimensions, extrusions, cuts, holes, patterns, revolutions, tolerance design, and 3D printing.
3	**CAD Assemblies, Prototyping, and Technical Drawings**	Rocket assemblies, drawings, exploded views, print preparation, physical prototypes, testing, revisions, and final presentation.
4	**Engineering Systems and Data**	Materials, mechanisms, motion, friction, data analysis, statistics, circuits, and electromechanical systems.
5	**Human-Centered Aerospace Design**	User needs, ethics, sustainability, life cycle, stakeholders, project management, teamwork, and design communication.
6	**Engineering Capstone**	A comprehensive design project requiring research, CAD, fabrication, testing, documentation, teamwork, and presentation.

Major Course Projects

01 Rocket Launch Pad Design Challenge	**02** Rocket disassembly, analysis, and redesign
03 Parametric CAD portfolio and tolerance tester	**04** Rocket CAD assembly and physical prototype
05 Engineering systems investigations and data analysis	**06** Stakeholder-centered aerospace design project
07 Final engineering capstone and portfolio presentation	

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

Engineering design projects and prototypes
CAD models, assemblies, drawings, and fabrication files
Engineering notebook and binder documentation
Labs, investigations, calculations, and data 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	Sketches, drawings, 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. The only way students may earn extra credit is by completing optional Engineering Challenges. Each unit will include approximately 3-5 challenges, and each successfully completed challenge is worth 10 extra-credit points.

Engineering Challenges extend course learning through additional design, problem-solving, research, CAD, fabrication, coding, or technical communication tasks. Challenges must meet all stated requirements, be submitted by the assigned deadline, and represent the student's own work. Extra credit may not be earned through replacement assignments, classroom supplies, donations, or unrelated activities.

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

For students who plan to take more engineering courses in the following school year, or who would prefer their own personal equipment – the following are some highly recommended materials for students.

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 will serve as each student's engineering notebook and course portfolio. The six dividers will be used to organize course information, notes, sketches and design documentation, assignments, project records, and assessments or portfolio work. The instructor will provide the required section labels and organization procedures at the beginning of the course.

CLASSROOM STORAGE

Students will have a designated place in the classroom to store their binder if they do not want to carry it to and from school each day. Students remain responsible for keeping the binder organized and bringing it home when needed.

SAFETY AND DAILY PRACTICE

Safe Work Is Professional Work

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FabLab Safety

Safety is a condition of participation in all fabrication, prototyping, and laboratory activities. Students must complete required safety instruction and equipment certifications before using tools or machines.

- 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, 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, fabrication, or testing, 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, or presentation activities may require an alternate assignment or a scheduled make-up opportunity.

COLLABORATION AND INTEGRITY

Own Your Work

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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 design.
- Complete assigned responsibilities and contribute to planning, 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 or CAD 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, 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, drawings, code, calculations, reports, notebook entries, data, 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

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Course Resources

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

LockwoodSTEM.org
Course hub for lessons, downloads, technical references, certifications, 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, 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

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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

_____

_____

_____

THANK YOU

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