# Engineering Design 1
# Course Compendium

**ENGINEERING DESIGN 1 Credits: 5 Grades: 9, 10, 11, 12 This course fulfills the graduation requirement for career education/practical arts.**

This course exposes students to the various fields of engineering and what it means to be an engineer. Math and science principles and concepts will be applied in a practical format. Areas of study include but are not limited to structures and mechanisms, control systems and product design. Students will utilize mechanical drawing techniques, as well as Computer Aided Design (CAD) software such as AutoCAD and Autodesk Inventor. Students will work collaboratively on real world engineering design problems requiring the application of valuable skills such as: hands-on problem solving, creative thinking, working within a team, creating engineering reports and presentations.

## UNITS OF STUDY*

Unit 1- *Introduction to Engineering Drawing*
Unit 2- *Computer Aided Design*
Unit 3- *Engineering Design*
Unit 4- *Structures & Forces*
Unit 5- *Mechanisms*
Unit 6- *Mechanical System Design*
Unit 7- *Electrical Circuits*
Unit 8- *Mechatronics*

## INTERDISCIPLINARY CONNECTIONS

### NJSLS Companion Standards Grades 9-12 (Reading & Writing in Science & Technical Subjects)

**RST.11-12.1.** Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
**RST.11-12.3.** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
**RST.11-12.7.** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
**NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
**NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation.
**NJSLSA.W8.** Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
**NJSLSA.W9.** Draw evidence from literary or informational texts to support analysis, reflection, and research.

**See individual units for Pacing Guide, NJSLS Standards, Transfer Skills, Enduring Understandings, Essential Questions, Learning Objectives, Key Vocabulary, Skills, Resources, & Assessments*

## Science Connections

**HS-ETS1-1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
**HS-ETS1-2.** Design a solution to a complex real- world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
**HS -ETS1-3.** Evaluate a solution to a complex real -world problem based on prioritized criteria and trade- offs that account for a range of constraints, including cost, safety, reliability , and aesthetics, as well as possible social, cultural, and environmental impacts. **HS-ETS1-4**. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

## 21st Century Life and Careers

**CRP1.** Act as a responsible and contributing citizen and employee.
**CRP4**. Communicate clearly and effectively and with reason.
**CRP7**. Employ valid and reliable research strategies.
**CRP11**. Use technology to enhance productivity.
**CRP12.** Work productively in teams while using cultural global competence
**9.3.ST.2** Use technology to acquire, manipulate, analyze and report data.
**9.3.ST.1** Apply engineering skills in a project that requires project management, process control and quality assurance.
**9.3.ST.5** Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
**9.3.ST-ET.6** Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

## Technology

**8.1.12.A.CS1** Understand and use technology systems.
**8.1.12.B.CS1** Apply existing knowledge to generate new ideas, products, or processes.
**8.2.12.A.1** Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation.
**8.2.12.A.2** Analyze a current technology and the resources used, to identify the trade-offs in terms of availability, cost, desirability and waste.
**8.2.12.B.2** Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.
**8.2.12.C.5** Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.
**8.2.12.D.3** Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.

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## GENERAL CONSIDERATIONS FOR DIVERSE LEARNERS

### English Language Learners

- Personal glossary
- Text-to-speech
- Extended time
- Simplified / verbal instructions
- Frequent breaks

WIDA Can Do Descriptors for Grade 9-12
WIDA Essential Actions Handbook
FABRIC Paradigm
Wall Township ESL Grading Protocol

*Use WIDA Can Do Descriptors in coordination with Student Language Portraits (SLPs).

### Students Receiving Special Education Services

- Small group/One to one
- Additional time
- Review of directions
- Student restates information
- Space for movement or breaks
- Extra visual and verbal cues and prompts
- Preferential seating
- Follow a routine/schedule
- Rest breaks
- Verbal and visual cues regarding directions and staying on task
- Checklists
- Immediate feedback

Students receiving Special Education programming have specific goals and objectives, as well as accommodations and modifications outlined within their Individualized Education Plans (IEP) due to an identified disability and/or diagnosis. In addition to exposure to the general education curriculum, instruction is differentiated based upon the student's needs. The IEP acts as a supplemental curriculum guide inclusive of instructional strategies that support each learner.

National Center on Universal Design for Learning - About UDL
UDL Checklist
UDL Key Terms

### Advanced Learners

- Use of high level academic vocabulary/texts
- Problem-based learning
- Preassess to condense curriculum
- Interest-based research
- Authentic problem-solving
- Homogeneous grouping opportunities

Knowledge and Skill Standards in Gifted Education for All Teachers
Pre-K-Grade 12 Gifted Programming Standards
Gifted Programming Glossary of Terms

### Students with 504 Plan

Teachers are responsible for implementing designated services and strategies identified on a student's 504 Plan.

### At Risk Learners / Differentiation Strategies

Alternative Assessments
Choice Boards
Games and Tournaments
Group Investigations
Guided Reading
Learning Contracts
Leveled Rubrics
Literature Circles
Multiple Texts
Personal Agendas

Independent Research & Projects
Multiple Intelligence Options
Project-Based Learning
Varied Supplemental Activities
Varied Journal Prompts or RAFT Writing
Tiered Activities/Assignments
Tiered Products
Graphic Organizers
Choice of Books/Activities
Mini-Workshops to Reteach or Extend
Think-Pair-Share by readiness or interest
Use of Collaboration of Various Activities

Jigsaw
Think-Tac-Toe
Cubing Activities
Exploration by Interest
Flexible Grouping
Goal-Setting with Students
Homework Options
Open-Ended Activities
Use of Reading Buddies
Varied Product Choices
Stations/Centers
Work Alone/Together

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