

Academy Engineering 1

Course Compendium

UNITS OF STUDY*

- Unit 1- Introduction to Engineering Drawing
- Unit 2- Computer Aided Design
- Unit 3- Engineering Design
- Unit 4- Engineering Entrepreneurship
- Unit 5- Structures and Forces
- Unit 6- Mechanical Systems
- Unit 7- Electronics
- Unit 8- Computer Science and Programming
- Unit 9- Robotics

This course is intended to introduce students to engineering design and the various fields of engineering. Areas of study include engineering drawing and graphics, computer aided drawing and design with rapid prototyping, the engineering design process, entrepreneurship in engineering, structural engineering, mechanical engineering, electrical engineering, computer science and programming. Students will work on real world engineering design problems which require the application of science and math concepts, creative thinking, teamwork, and digital documentation with technical writing.

INTERDISCIPLINARY CONNECTIONS

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

RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

NJSLSA.W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

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.

21st Century Life and Careers

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence

9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.

9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.

9.3.ST.3 Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.

9.3.ST.4 Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.

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.1 Use STEM concepts and processes to solve problems involving design and/or production.

9.3.ST-ET.2 Display and communicate STEM information.

9.3.ST-ET.4 Apply the elements of the design process.

9.3.ST-ET.5 Apply the knowledge learned in STEM to solve problems.

9.3.ST-SM.1 Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.

9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

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

9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.

Technology

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

8.1 Educational Technology: A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

8.1.12.A.CS1 Understand and use technology systems.

8.1 Educational Technology: B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative

products and process using technology.

8.1.12.B.CS1 Apply existing knowledge to generate new ideas, products, or processes.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: A. The Nature of Technology: Creativity and Innovation Technology systems impact every aspect of the world in which we live

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 Technology Education, Engineering, Design, and Computational Thinking - Programming: B. Technology and Society: Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in the global society

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: C. Design: The design process is a systematic approach to solving problems.

8.2.12.C.5 Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: D. Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.

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.

GENERAL CONSIDERATIONS FOR DIVERSE LEARNERS

English Language Learners	Students Receiving Special Education Services	Advanced Learners
<ul style="list-style-type: none"> - Personal glossary - Text-to-speech - Extended time - Simplified / verbal instructions - Frequent breaks <p>WIDA Can Do Descriptors for Grade 9-12 WIDA Essential Actions Handbook FABRIC Paradigm Wall Township ESL Grading Protocol</p> <p>*Use WIDA Can Do Descriptors in coordination with Student Language Portraits (SLPs).</p>	<ul style="list-style-type: none"> - 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 <p>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.</p> <p>Considerations for Special Education Students 6-12 National Center on Universal Design for Learning - About UDL UDL Checklist UDL Key Terms</p>	<ul style="list-style-type: none"> - Use of high level academic vocabulary/texts - Problem-based learning - Preassess to condense curriculum - Interest-based research - Authentic problem-solving - Homogeneous grouping opportunities <p>Knowledge and Skill Standards in Gifted Education for All Teachers Pre-K-Grade 12 Gifted Programming Standards Gifted Programming Glossary of Terms</p>
At Risk Learners / Differentiation Strategies		
<ul style="list-style-type: none"> Alternative Assessments Choice Boards Games and Tournaments Group Investigations Learning Contracts Leveled Rubrics Literature Circles Multiple Texts Personal Agendas Homogeneous Grouping 	<ul style="list-style-type: none"> Independent Research & Projects Multiple Intelligence Options Project-Based Learning Varied Supplemental Activities Varied Journal Prompts Tiered Activities/Assignments Tiered Products Graphic Organizers Choice of Activities Mini-Workshops to Reteach or Extend Think-Pair-Share by readiness or interest Use of Collaboration of Various Activities 	<ul style="list-style-type: none"> Jigsaw Think-Tac-Toe Cubing Activities Exploration by Interest Flexible Grouping Goal-Setting with Students Homework Options Open-Ended Activities Varied Product Choices Stations/Centers Work Alone/Together

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

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