CAE-Unit-Plan-2A-Curriculum- Springs

Content Area: **CTE**
Course(s): **Computer Aided Engineering**
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Unit Overview

Springs are mechanical devices that are used to store and apply mechanical energy. Springs can be designed and manufactured to apply a pushing action, pulling action or a twisting action. It is the job of the engineer/designer to specify the information necessary to describe all springs and their application in a particular product design.

Enduring Understandings

The following synthesizes the important ideas and core processes that are central to the CAD discipline and will have lasting value beyond the classroom:

- Springs are mechanical devices used to store and apply energy.
- Springs can be used to apply a pushing, pulling or twisting force to a design.
- Helical-type springs include: Compression springs, extension springs and torsion springs.
- The free length of a spring is an important dimension used during the design process and represents the overall length of the spring when it is unloaded.
- The solid length of a compression spring is an important dimension used during the design process and represents the overall length of the spring when it is completely compressed together.
- A drawing/design that incorporates the use of a spring must include all required data and dimensions necessary to completely describe the spring being used.
- A drafter/designer must be familiar with, or be able to access information such as terminology and the formulas necessary to properly represent springs in a technical drawing.

Essential Questions

1. What is the main purpose of using springs in a design?
2. What are the different kinds of forces a spring can either store or apply?
3. What are the 4 different types of helical compression springs?
4. Why are the free and solid length dimensions of a compression spring important to the design process?
5. What formulas are necessary to create drawings of compression springs? How are they implemented?
6. What terminology is most often used when creating technical drawings of helical springs?
7. What required data must be provided by the drafter/designer in order to fully describe the use of a spring in a technical drawing?

Standards/Indicators/Student Learning Objectives (SLOs)

ARCH.9-12.3	Maintenance and Operations
ARCH.9-12.9.4.12.B.(2).4	Identify project turnover procedures needed to successfully manage construction projects.
ARCH.9-12.9.4.12.B.(2).5	Plan building in accordance with contracts to meet budget and schedule.
ARCH.9-12.9.4.12.B.(2).6	Describe testing and inspection procedures used to ensure successful completion of construction projects.
ARCH.9-12.9.4.12.B.(2).7	Assess the purpose for scheduling as it relates to successful completion of construction projects.
ARCH.9-12.9.4.12.B.(2).8	Identify closeout procedures needed to effectively complete construction projects.
ARCH.9-12.9.4.12.B.(2).9	Demonstrate understanding of risk management principles and other strategies and tactics used to maintain, increase, or decrease risk.
ARCH.9-12.9.4.12.B.(2).10	Create a jobsite safety program to ensure safe practices and procedures.
ARCH.9-12.9.4.12.B.(2).12	Describe procedures for jobsite security to prevent liability.
ARCH.9-12.9.4.12.B.(2).15	Demonstrate knowledge of proper changeover procedures for successful completion of a construction project.
ARCH.9-12.9.4.12.B.(2).16	Examine building systems and components to evaluate their usefulness to construction projects.
ARCH.9-12.9.4.12.B.(2).17	Use craft skills to meet or exceed teacher and/or employer expectations.
ARCH.9-12.9.4.12.B.(3).1	Recognize and employ universal construction signs and symbols to function safely.
ARCH.9-12.9.4.12.B.(3).2	Use troubleshooting procedures when solving a maintenance problem to maintain project.
ARCH.9-12.9.4.12.B.(3).3	Apply construction skills when completing classroom projects and/or repairing, restoring, or renovating existing worksite structures to ensure long-term use of buildings and structures.
ARCH.9-12.9.4.12.B.(3).4	Evaluate and assess an existing structure to determine the repairs or renovations required to restore operation of the structure.
ARCH.9-12.9.4.12.B.(3).5	Plan and practice preventive maintenance activities to service existing structures.
ARCH.9-12.9.4.12.B.1	Demonstrate language arts knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
ARCH.9-12.9.4.12.B.2	Demonstrate mathematics knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
ARCH.9-12.9.4.12.B.3	Demonstrate science knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
ARCH.9-12.9.4.12.B.4	Perform math operations, such as estimating and distributing materials and supplies, to complete classroom/workplace tasks.
ARCH.9-12.9.4.12.B.5	Apply principles of physics, as they relate to worksite/jobsite situations, to work with materials and load applications.
ARCH.9-12.9.4.12.B.7	Demonstrate use of the concepts, strategies, and systems for obtaining and conveying ideas and information to enhance communication.
ARCH.9-12.9.4.12.B.8	Locate, organize, and reference written information from various sources to communicate with others.
ARCH.9-12.9.4.12.B.9	Evaluate and use information resources to accomplish specific occupational tasks.

Roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment impact business operations. Key organizational systems impact organizational performance and the quality of products and services. Understanding the global context of 21st-century industries and careers impacts business operations.

All clusters rely on effective oral and written communication strategies for creating, expressing, and interpreting information and ideas that incorporate technical terminology and information.

Academic concepts lay the foundation for the full range of career and post-secondary education opportunities within the career cluster.

Lesson Titles

- Introduction to Springs
- Notes and Terminology
- Helical Spring Applications
- Spring Design Project

Career Readiness, Life Literacies, & Key Skills

TECH.9.4.12.CI.1	Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
TECH.9.4.12.CI.2	Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8).
TECH.9.4.12.CI.3	Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).

Inter-Disciplinary Connections

- Applied **Mathematics**
- **Arts** Related to Product "Form"
- **Historical** References & Perspectives
- Technical **Literacy**
- Applied **Sciences**

0x	Connections to Equations.
0x	During high school, students begin to formalize their geometry experiences from elementary and middle school, using more precise definitions and developing careful proofs. Later in college some students develop Euclidean and other geometries carefully from a small set of axioms.
0x	In real world problems, the answers are usually not numbers but quantities: numbers with units, which involves measurement. In their work in measurement up through Grade 8, students primarily measure commonly used attributes such as length, area, and volume. In high school, students encounter a wider variety of units in modeling, e.g., acceleration, currency

	conversions, derived quantities such as person-hours and heating degree days, social science rates such as per-capita income, and rates in everyday life such as points scored per game or batting averages. They also encounter novel situations in which they themselves must conceive the attributes of interest. For example, to find a good measure of overall highway safety, they might propose measures such as fatalities per year, fatalities per year per driver, or fatalities per vehicle-mile traveled. Such a conceptual process is sometimes called quantification. Quantification is important for science, as when surface area suddenly "stands out" as an important variable in evaporation. Quantification is also important for companies, which must conceptualize relevant attributes and create or choose suitable measures for them.
LA.9-0x10.RH.9-10.3	Analyze in detail a series of events described in a text; draw connections between the events, to determine whether earlier events caused later ones or simply preceded them.
LA.9-0x10.RH.9-10.9	Compare and contrast treatments of the same topic, or of various perspectives, in several primary and secondary sources; analyze how they relate in terms of themes and significant historical concepts.
LA.9-0x10.RST.9-10.5	Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).

Anticipatory Set

Possibilities of short activities that will focus the student's attention before the actual lesson begins:

1. **Vocabulary connections-** terms and definitions in a short game of "Trash-ketball"
2. **Challenge**- Offer students sketching task and let them try to solve it as a group then present it to the class.
3. **Challenge**- Offer a volunteer student a CAD task and let him/ her solve it on the board.
4. **Use manipulatives or models**

- **Description:** Teacher will use physical models to prepare students to learn a specific concept or better highlight the critical attributes of new concepts. Teacher will use a variety of models of two or three-dimensional shapes.

1. **Show & Tell**: Use a prop from an article students are about to read related to industry. Examples: Professional drawings - Architectural, Interior Design, Engineering.
2. **Use a visual**- Teacher will use visual aides to encourage students to better connect to new concepts. Examples: Real drawings used in industry- Architectural, Interior Design, Engineering. The teacher will tell students that they have thirty seconds to remember everything they can about the drawing. After the thirty seconds, the teacher will remove the drawings and ask students to recall all they can about them. The teacher will solicit ideas and use this to introduce distinguishing between main idea and supporting details.

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK

Direct Instruction

- **Possibilities include**
    - Structured Overview
    - Lecture
    - Explicit Teaching
    - Drill & Practice
    - Compare & Contrast
    - Didactic Questions
    - Demonstrations
    - Guided & Shared - reading, listening, viewing, thinking

Interactive Instruction

- **Possibilities include**
    - Debates
    - Role Playing
    - Panels
    - Brainstorming
    - Peer Partner Learning
    - Discussion
    - Laboratory Groups
    - Think, Pair, Share
    - Cooperative Learning Groups
    - Jigsaw
    - Problem Solving
    - Structured Controversy
    - Tutorial Groups
    - Interviewing
    - Conferencing

Indirect Instruction

- **Possibilities include**
    - Problem Solving
    - Case Studies
    - Reading for Meaning
    - Inquiry
    - Reflective Discussion
    - Writing to Inform
    - Concept Formation
    - Concept Mapping
    - Concept Attainment
    - Cloze Procedure

Independent Study

- **Possibilities include**
    - Essays

- Computer Assisted Instruction
- Journals
- Learning Logs
- Reports
- Learning Activity Packages
- Correspondence Lessons
- Learning Contracts
- Homework
- Research Projects
- Assigned Questions
- Learning Centers

Experiential Learning

- **Possibilities include**
  - Field Trips
  - Narratives
  - Conducting Experiments
  - Simulations
  - Games
  - Storytelling
  - Focused Imaging
  - Field Observations
  - Role-playing
  - Model Building
  - Surveys

Instructional Skills

- **Possibilities include**
  - Explaining
  - Demonstrating
  - Questioning
  - Questioning Technique
  - Wait Time
  - Levels of Questions

Modifications

Instructor implements the following teaching strategies with students who need special accommodations. Instructor also implements specific requirements from the students' individual reports.

- Classroom:
  - Seat student near instruction, avoid distracting stimuli
  - Clarify that student understands directions

    - Cuing student to refocus (verbal/nonverbal)
    - Praise for positive behaviors.
    - Study guides provided, when available. Prior knowledge to upcoming quizzes/tests.
- Standardized Testing:
    - Extra Time
    - Repeating, clarifying, or rewording directions.
- Delsea One – Students benefit from increased opportunities for enrichment and tutoring during Delsea One Tutoring.

At risk modifications

The possible list of modifications/accommodations identified for Special Education students can be utilized for At-Risk students. Teachers should utilize ongoing methods to provide instruction, assess student needs, and utilize modifications specific to the needs of individual students. In addition, the following may be considered:

- Additional time for assignments .
- Adjusted assignment timelines .
- Agenda book and checklists .
- Answers to be dictated .
- Assistance in maintaining uncluttered space .
- Books on tape .
- Concrete examples .
- Extra visual and verbal cues and prompts .
- Follow a routine/schedule .
- Graphic organizers .
- Have students restate information .
- No penalty for spelling errors or sloppy handwriting .
- Peer or scribe note-taking .
- Personalized examples .
- Preferential seating .
- Provision of notes or outlines .
- Reduction of distractions .
- Review of directions .
- Review sessions .
- Space for movement or breaks .
- Support auditory presentations with visuals .
- Teach time management skills .
- Use of a study carrel .
- Use of mnemonics .
- Varied reinforcement procedures .

- Work in progress check .

ELL Modifications

-
  - Choice of test format (multiple-choice, essay, true-false)
  - Continue practicing vocabulary
  - Provide study guides prior to tests
  - Read directions to the student
  - Read test passages aloud (for comprehension assessment)
  - Vary test formats

IEP & 504 Modifications

- Allow for redos/retakes
- Assign fewer problems at one time (e.g., assign only odds or evens)
- Differentiated center-based small group instruction
- Extra time on assessments
- Highlight key directions
- If a manipulative is used during instruction, allow its use on a test
- Opportunities for cooperative partner work
- Provide reteach pages if necessary
- Provide several ways to solve a problem if possible
- Provide visual aids and anchor charts
- Test in alternative site
- Tiered lessons and assignments
- Use of a graphic organizer
- Use of concrete materials and objects (manipulatives)
- Use of word processor

G&T Modifications

-
  - Alternate assignments/enrichment assignments
  - Enrichment projects
  - Extension activities
  - Higher-level cooperative learning activities
  - Pairing direct instruction with coaching to promote self-directed learning

- Provide higher-order questioning and discussion opportunities
- Provide texts at a higher reading level
- Tiered assignments
- Tiered centers

Formative Assessment

- Observations during in-class activities; of students' non-verbal feedback during lecture.
- Homework exercises as review for exams and class discussions.
- Reflections journals that are reviewed periodically during the semester.
- Question and answer sessions, formal—planned and informal—spontaneous.
- Conferences between the instructor and student at various points in the semester.
- In-class activities where students informally present their results.
- Student feedback collected by periodically answering specific question about the instruction and their self-evaluation of performance and progress.

Benchmark Assessment

Skills-based assessment

Reading response

Writing prompt

Lab practical

Alternative Assessment

Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Reflective pieces

Concept maps

Case-based scenarios

Portfolios

Summative Assessment

- Quiz, Test, MP Assessments about the specified lesson:- Springs
- Final examination (a truly summative assessment) about the specified lesson.
- Projects (project phases submitted at various completion points could be formatively assessed) about the specified lesson.
- Portfolio that include all class assignments.
- Student evaluation of the lesson (teaching effectiveness).
- Instructor self-evaluation about the current lesson
- By Rubric shown below.

Computer Aided Design Evaluation Rubric

Category	**1** **Does Not Meet Expectations** (0-25% of points)	**2** **Attempted to Meet Expectations** (25-50% of points)	**3** **Meets Expectations** (50-75% of points)
Defining the Problem	Offers an unclear statement of the problem. There is no support, documentation, or need for development. Little or no work is evident.	A short description and explanation is offered to the problem without any support and specifications for development pursuits.	A good statement and support/documentation is given to suggest the need to develop the product. Design specifications and constraints are also noted.
Research, Brainstorming, and Developing Ideas	Little research and brainstorming accomplished. Ideas generated are not original.	Research is evident as an outcome of brainstorming. Ideas generated are a result of the brainstorming process and not original.	Ideas generated are new and original as an outcome of brainstorming and research. Little suggestions are offered for the rest of the design process if any.
Conceptual Design and Sketching	Only one sketch is offered for a design review.	At least two sketches are offered for a review. The sketches offer no design specifications or annotation.	More than two sketches are offered for a review. The sketches include design specifications and annotation for developing the design.

Category	1 **Does Not Meet Expectations** (0-25% of points)	2 **Attempted to Meet Expectations** (25-50% of points)	3 **Meets Expectations** (50-75% of points)
Developing the Design	A set of sketched working drawings without an assembly drawing. 3D representations of each part of the assembly on the working drawings are missing. Annotations, dimensioning and blocks are not accurate.	A set of production drawings with an assembly and working drawings. Each orthographic drawing includes a 3D representation. Annotations, notations, blocks, and dimensioning are inaccurate.	A set of production drawings with an assembly and workin drawings. Mulitview drawings are added additiona to orthographic drawings. A 3D representation is included on all multiview drawings. Annotations, notations, blocks, and dimensioning are slightly inaccurate.
Making a Model or Prototype	Model is missing or does not look like concept sketches.	Model is proportional to sketches, inaccurate in scale, and dimensioning does not follow industry standards.	Model is accurate in proportion and dimensioning according to concept sketches and industry standards.
Engineering Testing and Evaluating the Design	Testing and evaluating designs/model are missing or not checked/approved.	Testing and verification attempted by checks and approvals without results.	Testing and verification are complete with checks/approvals and detailed results are not following industry standards.

Category	1 **Did Not Meet Expectations** (0-25% of points)	2 **Attempted to Meet Expectations** (25-50% of points)	3 **Meets Expectations** (50-75% of points)
Revising the Design	No attempt made to revise the design. Revision blocks not completed.	Designs revised without revision blocks completed.	Designs revised according to change requests and revision blocks filled out appropriately, but no approva or checking sought after the first revision.
Creating a Final	Missing prototype model or	Mockup or prototype model is	Prototype model or mockup i

Model, Prototype, or Mockup	mockup.	not accurate according to production drawings	accurate according to production drawing and created out of materials not specified.
Presentation	A presentation given without preparation and an outline.	A presentation given without a professional presence, good public speaking and a well thought out organized outline.	An organized outlined presentation with a professional presence, a written proposal, good public speaking and visual aids.

Resources & Materials

- Residential Housing and Interiors, 4th Edition b**y:** Clois E. Kicklighter, Ed. D. and Joan C. Kicklighter
- Housing and Interior Design By: Evelyn L. Lewis, Ed.D., Carolyn Turner Smith, Ph.D
- Interior Design By : Stephanie Clemons
- Glencoe Mechanical Drawing: Board and CAD Techniques, Student Edition: 1st (First) Edition by Glencoe McGraw-Hill
- Basic Technical Drawing by Spencer, Dygon, Novak Glencoe McGraw-Hill
- Exploring Drafting, Instructor's Manual Instructor's Manual, 10th Edition by John R. Walker (Author), Bernard D. Mathis

Technology

Specific technology resources include:

- AutoDesk Home Styler- Interiors Software
- Google SketchUp Software
- AutoCAD Architecture Software
- Smart boards
- Computers
- Chrome Books
- 3D printer
- Large format Printer (plotter)

Standard	**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.**

Grade Level bands	**Content Statement** **Students will be able to understand:**	**Indicator**	**Indicator**
9-12	The characteristics and scope of technology.	**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.
	The core concepts of technology.	**8.2.12.A.2**	Analyze a current technology and the resources used, to identify th trade-offs in terms of availability, cost, desirability and waste.
	The relationships among technologies and the connections between technology and other fields of study.	**8.2.12.A.3**	Research and present information on an existing technological product that has been repurposed for a different function.

Content Area	**Technology**		
Standard	**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.**		
Strand	**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.*		
Grade	**Content Statement** **Students will be able to**	**Indicator**	**Indicator**

Level bands	understand:		
9-12	The cultural, social, economic and political effects of technology.	**8.2.12.B.1**	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.
	The effects of technology on the environment.	**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.
	The role of society in the development and use of technology.	**8.2.12.B.3**	Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.
	The influence of technology on history.	**8.2.12.B.4**	Investigate a technology used in a given period of history, e.g., ston age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.
		8.2.12.B.5	Research the historical tensions between environmental and economic considerations as driven by human needs and wants in th development of a technological product, and present the competing viewpoints to peers for review.

Content Area	**Technology**		
Standard	**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.**		
Strand	**C. Design:** ***The design process is a systematic approach to solving problems.***		
Grade Level bands	**Content Statement** **Students will be able to understand:**	**Indicator**	**Indicator**
9-12	The attributes of design.	**8.2.12.C.1**	Explain how open source technologies follow the design process.
		8.2.12.C.2	Analyze a product and how it has changed or might change over time to meet human needs and wants.
	The application of engineering design.	**8.2.12.C.3**	Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).
		8.2.12.C.4	Explain and identify interdependent systems and their functions.
		8.2.12.C.5	Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.

	The role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.	**8.2.12.C.6**	Research an existing product, reverse engineer and redesign it to improve form and function.
		8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.

Content Area	**Technology**		
Standard	**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.**		
Strand	**E. Computational Thinking: Programming:** *Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.*		
Grade Level bands	**Content Statement** **Students will be able to understand:**	**Indicator**	**Indicator**

9-12	**Computational thinking and computer programming as tools used in design and engineering.**	**8.2.12.E.1**	Demonstrate an understanding of the problem-solving capacity of computers in our world.
		8.2.12.E.2	Analyze the relationships between internal and external computer components.
		8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
		8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).