

Drafting - General

Course Description

This course involves a careful examination of drafting as a tool of technical communication and for solving graphical problems. Emphases are on development of basic drafting skills, visualization, and solution of spatial problems. It is an exploratory, first course in drafting designed primarily for students planning to enroll in the regular-program Drafting Technology courses upon completion of this course. However, it also meets the needs of many students with other interests, as a refresher course in drafting, a course for upgrading drafting skills, a course for engineering students training to be public school industrial arts teachers, or a course that provides students with a general "feel" for the subject of drafting.

Drafting – General

Pacing Guide		
Unit	Topic	Suggested Timing
Unit 1	Introduction to Drafting	approx. 9 weeks
Unit 2	Drafting Techniques and Skills	approx. 9 weeks
Unit 3	Descriptive Geometry	approx. 9 weeks
Unit 4	Advanced Applications and Design Special	approx. 8 weeks

Educational Technology Standards

8.1.12.A.1, 8.1.12.B.2, 8.1.12.C.1, 8.1.12.D.1, 8.1.12.E.1, 8.1.12.F.1

- **Technology Operations and Concepts**
 - Create a personal digital portfolio which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.
- **Creativity and Innovation**
 - Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
- **Communication and Collaboration**
 - Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
- **Digital Citizenship**
 - Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
- **Research and Information Literacy**
 - Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
- **Critical Thinking, Problem Solving, Decision Making**
 - Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. Act as a responsible and contributing citizen and employee

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP3. Attend to personal health and financial well-being.

Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

CRP4. Communicate clearly and effectively and with reason.

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

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

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

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

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.

Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP10. Plan education and career paths aligned to personal goals.

Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP11. Use technology to enhance productivity.

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRP12. Work productively in teams while using cultural global competence.

Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Differentiated Instruction

Strategies to Accommodate Students Based on Individual Needs

<u>Time/General</u>	<u>Processing</u>	<u>Comprehension</u>	<u>Recall</u>
<ul style="list-style-type: none"> • Extra time for assigned tasks • Adjust length of assignment • Timeline with due dates for reports and projects • Communication system between home and school • Provide lecture notes/outline 	<ul style="list-style-type: none"> • Extra Response time • Have students verbalize steps • Repeat, clarify or reword directions • Mini-breaks between tasks • Provide a warning for transitions • Reading partners 	<ul style="list-style-type: none"> • Precise step-by-step directions • Short manageable tasks • Brief and concrete directions • Provide immediate feedback • Small group instruction • Emphasize multi-sensory learning 	<ul style="list-style-type: none"> • Teacher-made checklist • Use visual graphic organizers • Reference resources to promote independence • Visual and verbal reminders • Graphic organizers
<u>Assistive Technology</u>	<u>Tests/Quizzes/Grading</u>	<u>Behavior/Attention</u>	<u>Organization</u>
<ul style="list-style-type: none"> • Computer/whiteboard • Tape recorder • Spell-checker • Audio-taped books 	<ul style="list-style-type: none"> • Extended time • Study guides • Shortened tests • Read directions aloud 	<ul style="list-style-type: none"> • Consistent daily structured routine • Simple and clear classroom rules • Frequent feedback 	<ul style="list-style-type: none"> • Individual daily planner • Display a written agenda • Note-taking assistance • Color code materials

Enrichment

Strategies Used to Accommodate Based on Students Individual Needs:

- Adaption of Material and Requirements
- Evaluate Vocabulary
- Elevated Text Complexity
- Additional Projects
- Independent Student Options
- Projects completed individual or with Partners
- Self Selection of Research
- Tiered/Multilevel Activities
- Learning Centers
- Individual Response Board
- Independent Book Studies
- Open-ended activities
- Community/Subject expert mentorships

Assessments

Suggested Formative/Summative Classroom Assessments

- Vocabulary recognition games
- Teacher-created Unit Assessments, Chapter Assessments, Quizzes
- Teacher-created Essays, Short Answer
- Drawing and sketch accuracy tests and quizzes
- Group projects – students will brainstorm and create drawings and sketches as a group of two and present to the class, Portfolios which students can put in a binder and save for the college application process
- Homework
- Research careers in drafting and create a PowerPoint presentation
- Create sample technical drawings- graphic representation of a real life object
- Students will decide on a model they would like to draw but must use the design model step-by-step to complete the process, this can be used as a summative project. Students will create a statement; explain the requirements needed to complete the model, discussion in relation to the limitations and restrictions which could pose a problem throughout the design process, conduct research about the specifics of the model. Lastly, preliminary solutions and decision and implementation steps will be executed.

Interdisciplinary Connections

English Language Arts

- Journal writing
- Close reading of industry-related content
- Create a brochure for a specific industry
- Keep a running word wall of industry vocabulary

Social Studies

- Research the history of a given industry/profession
- Research prominent historical individuals in a given industry/profession
- Use historical references to solve problems

World Language

- Translate industry-content
- Create a translated index of industry vocabulary
- Generate a translated list of words and phrases related to workplace safety

Math

- Research industry salaries for a geographic area and juxtapose against local cost of living
- Go on a geometry scavenger hunt
- Track and track various data, such as industry's impact on the GDP, career opportunities or among of individuals currently occupying careers

Fine & Performing Arts

- Create a poster recruiting young people to focus their studies on a specific career or industry
- Design a flag or logo to represent a given career field

Science

- Research the environmental impact of a given career or industry
- Research latest developments in industry technology
- Investigate applicable-careers in STEM fields

New Jersey Student Learning Standards

9.3–Architecture and Construction (AC)

Career Cluster: Architecture and Construction (AC)

- 9.3.12.AC.1 Use of vocabulary, symbols and formulas common to architecture and construction
- 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project

Pathway: Design/Preconstruction(AC-DES)

- Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues
- 9.3.12.AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects

Pathway: Maintenance/Operations (AC-MO)

- 9.3.12.AC-MO.1 Recognize and employ universal construction signs and symbols to function safely in the workplace

Common Career Technical Core (CCTC)

Architecture and Construction (AC)

- AC.1 Use of vocabulary, symbols and formulas common to architecture and construction
- AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project

Pathway: Design/Preconstruction(AC-DES)

- AC-DES.2 Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues
- AC-DES.6 Apply the techniques and skills of modern drafting, design, engineering and construction to projects

Pathway: Maintenance/Operations (AC-MO)

- AC-MO.1 Recognize and employ universal construction signs and symbols to function safely in the workplace

Common Core State Standards (CCSS)

CCSS - English-Language Arts

Key Ideas and Details:

Research to Build and Present Knowledge:

- CCSS.ELA-LITERACY.W.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Range of Writing:

- CCSS.ELA-LITERACY.W.11-12.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences

Common Core State Standards (CCSS)

CCSS – Mathematics

Make Geometric Constructions

- CCSS.MATH.CONTENT.G.CO.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.
- CCSS.MATH.CONTENT.G.CO.13 Construct an equilateral triangle, a square, and a rectangular hexagon inscribed in a circle

Course: Drafting - General Unit: 4- Advanced Applications Grade Level: 9-12	Unit Overview: Students will be able to apply drawing techniques to the common types of geometric dimensioning and tolerancing used in Drafting.
New Jersey Student Learning Standards (NJSLS): 9.3.12.AC.1 9.3.12.AC.6 9.3.12.AC-DES.2 9.3.12.AC-DES.6 9.3.12.AC-MO.1	
Common Career Technical Core (CCTC): AC.1 AC.6 AC-DES.2 AC-DES.6 AC-MO.1	
Common Core State Standards (CCSS): W.11-12.7 W.11-12.10 G.CO.12 G.CO.13	

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
Apply dimensioning and tolerancing to drafting problems. NSLS 9.3.12.AC.1 CCTC: AC-MO.1 CCSS: W.11-12.7	Why is accurate tolerancing crucial in drafting?	Measurement of basic size Measuring actual design size after applications Measuring design size after allowances are applied	Teacher Provided Drawing Teacher will provide students with a sample blocked drawing which includes designated measurements, students will calculate and define basic size, and actual design size in prior to creating a model	Geometric dimensioning and tolerancing https://www.youtube.com/channel/UCYncQXpg9RmilL1ukax-USQ Introduction to tolerancing and dimensioning https://www.youtube.com/watch?v=aS9OgYadjpY Dimensioning Tutorial

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
				https://www.youtube.com/watch?v=c20BLIrY4Ik
<p>Interpret and apply common terms used in geometric dimensioning and tolerancing</p> <p>NJSLS :9.3.12.AC.6</p> <p>CCTC: AC-DES.6</p> <p>CCSS: W.11-12.7 G.CO.12</p>	<p>What are the most commonly used terms in geometric dimensioning and tolerancing?</p>	<p>Vocabulary and definition recognition</p> <p>Application and understanding of vocabulary terms when attempting to draw and measure models</p> <p>Creation of block models using common vocabulary as a guide to produce models with accuracy</p>	<p><u>Vocabulary Assessment</u></p> <p>Students will be provided with flashcards which have the vocabulary words typed on them. In groups of two, each student will play a matching game in which they must pair the correct vocabulary term with the proper definition.</p> <p>Students will create a study guide which highlights all the common terms associated with dimensioning and tolerancing</p>	<p>Symbols and terms https://www.youtube.com/watch?v=O8RF7t7PArw</p> <p>Geometric Tolerancing and Dimensioning Symbols and Terms https://www.youtube.com/watch?v=AVC1m8mkSmE</p> <p>Tolerancing https://www.youtube.com/watch?v=kaJ9xk_ih4U</p>
<p>List and apply the different types of</p>	<p>How do the various types of tolerances used</p>	<p>Identification of the tolerance types used to</p>	<p><u>Identification of Tolerance Types</u></p>	<p>Low Tolerance Part Implementation</p>

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
<p>tolerances used to control fits for machine parts</p> <p>NJSLS: 9.3.12.AC.6</p> <p>CCTC: AC.1</p> <p>CCSS: .W.11-12.7</p>	<p>to control fits for a machine parts assure accurate model development?</p>	<p>control fits for machine parts</p> <p>Application of tolerances to determine accuracy when developing models</p>		<p>https://www.youtube.com/watch?v=wQH-JsRRpS0</p> <p>Workholding to Maintain Machine Tolerance https://www.youtube.com/watch?v=iNktbdhvGDA</p> <p>CNC Machining in Tolerancing Parts https://www.youtube.com/watch?v=ZbRZGdONt9o</p>
<p>Identify specific symbols used in geometric dimensioning and tolerancing applications</p> <p>NJSLS: 9.3.12.AC-DES.6</p> <p>CCTC: AC-DES.6</p> <p>CCSS: G.CO.12 G.CO.13</p>	<p>How many specific geometric symbols are used when dimensioning or tolerancing applications prior to model development?</p>	<p>Ability to draw the fourteen geometric characteristic symbols used in tolerancing and dimensioning</p> <p>Ability to create geometric characteristic symbols manually or CAD style</p>	<p><u>Drawing Geometric Symbols</u></p> <p>Students will be provided with construction paper and markers. Each student will draw the fourteen symbols on individual sheets of a paper and attached them into drafting binders as a reference sheet.</p>	<p><u>Geometric Dimensioning Applications</u> https://www.youtube.com/watch?v=v4Z3btmB5r4</p> <p><u>Geometric Sequencing</u> https://www.youtube.com/watch?v=47rTeRJxQ3Y</p> <p><u>Geometric dimensioning fundamentals</u></p>

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
				https://www.youtube.com/watch?v=4Gozp8Cegc4
<p>Explain the standard practices for applying tolerance dimensions to drawings</p> <p>NJSLS: 9.3.12.AC.6</p> <p>CCTC: AC-DES.6</p> <p>CCSS: W.11-12.7</p>	<p>How dimensions are accurately applied to drawings?</p>	<p>identification of tolerance commands</p> <p>Application of tolerance commands in relation to drawings</p>	<p>Provided Drawing</p> <p>Students will be given a drawing with accurate measurements, they will be expected to identify tolerance commands and apply the commands both manually and CAD style</p>	<p>Tolerance Drawings https://www.youtube.com/watch?v=4cenc8ffths</p> <p>Importing Dimensions and Tolerances from Drawings https://www.youtube.com/watch?v=IBg2O1QvZYI</p> <p>Dimension Styles https://www.youtube.com/watch?v=GSTHsA-vHVY</p>
<p>Apply techniques to draw tolerance dimensions in CAD drawings</p> <p>NJSLS: 9.3.12.AC-DES.6</p>	<p>How is the appearance of dimensions on CAD drawings controlled by dimensions of styles?</p>	<p>Ability to place dimensions automatically with dimensioning commands</p> <p>Drawing basic</p>	<p>CAD Commands</p> <p>Using CAD commands, the students will create geometric dimensioning and tolerancing symbols</p>	<p>How to Add Dual Dimensions and Tolerance in Auto CAD https://www.youtube.com/watch?v=GSTHsA-vHVY</p>

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
<p>CCTC: AC-MO.1</p> <p>CCSS: W.11-12.10 G.CO.12.W.11-12.7</p>		<p>dimensions, limit dimensions, and tolerance dimensions with unilateral or bilateral tolerances</p>	<p>Drawing Figures Students will draw dimensioned figures utilizing basic dimensions and geometric dimensioning and tolerancing symbols.</p>	<p>Auto CAD Adding General Dimensions https://www.youtube.com/watch?v=ZYChKlwFgrQ</p> <p>Auto CAD Dimensioning and Tolerancing https://www.youtube.com/watch?v=ItDQs333eh8</p>

Unit Vocabulary

Actual size Allowance Angularity Angular surface tolerancing Annular space Baseline dimensioning Basic dimension Basic hole size Basic hole size system Basic shaft size Basic size Bilateral tolerance Chain dimensioning Circularity Circular runout Clearance fit Concentricity Cylindricity Datum	Datum dimensioning Datum feature symbol Datum target Design size Feature control frame Fit Flatness Force fits Form tolerances Geometric characteristic symbols Geometric dimensioning and tolerancing Interchangeable manufacture Interference fit Lay Least material condition (LMC) Limit dimensioning
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Suggested Structured Learning Experiences

High school students will tour the architecture program at Rowan University to compare the pros and cons amongst programs in NJ. Also, students will get a better understanding of what college expect in terms of academics, portfolio creations, and extracurricular activities requirements.

**Rowan University
 School of Architecture
 201 Mullica Hill Road
 Glassboro, NJ 08028**

Students will tour the prestigious Princeton University to explore the architecture and design program, and experience an accelerated, fast-paced educational environment.

**Princeton University
 School of Architecture
 110 West College
 Princeton, NJ 08544**

Suggested Unit Projects

Choose At Least One

Students will construct geometric dimensioning and tolerancing drawings in groups of two, each student will be responsible for accurate measurements and proper use of dimension styles to complete the task.

Students will create portfolios which contain CAD and manual drawings

Students will complete a diagram which illustrates the how to properly use geometric symbols, diagram will serve as guides to be posted in the drafting classroom.

Students will combine CAD drawings with geometric illustrations to create real-life models