

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

<p>Course: Drafting - General Unit: I – Introduction to General Drafting Grade Level: 9-12</p>	<p>Unit Overview: Students will be exposed to the various techniques in drafting and the types of drafting equipment. In addition, CAD commands and functions will be introduced to bring awareness to their connection to General Drafting. Students will be able to complete tasks centered on sketching, lettering, and text. The four step design model will be introduced and awareness in careers in drafting will be discussed.</p>
<p>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</p>	
<p>Common Career Technical Core (CCTC): AC.1 AC.6 AC-DES.2 AC-DES.6 AC-MO.1</p>	
<p>Common Core State Standards (CCSS): W.11-12.7 W.11-12.10 G.CO.12 G.CO.13</p>	

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
<p>Identify and use the most common drafting tools, NJSLS: 9.3.12.AC.1 CCTC: AC-MO.1 CCSS: W.11-12.7</p>	<p>What is the most important drafting tool, in your opinion? How will having the ability to identify key drafting tools increase my ability to draw and design with accuracy? In what other scenarios may I have used, or will use, a drafting tool?</p>	<p>Identifying key tools in drafting: Identify key tools used to construct accurate drawings</p>	<p>Marketing A Tool Students will create a marketing campaign to advertise the benefits of a specific/assigned drafting tool Scavenger Hunt Scavenger hunt to identify drafting tools.</p>	<p>Drafting Tools http://www2.wisd.net/archive/industrialtech/DRAFTING/draftingtools.htm Drafting Tools Video: https://www.youtube.com/watch?v=PREI1YyGhQI</p>

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
<p>Students will be able to apply knowledge and skills to sketch and communicate ideas.</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 makes communicating ideas difficult?</p> <p>Why is it important?</p> <p>How can technical drawings and sketches assist students with completing real –life models?</p>	<p>Identifying technical drawings: Identify technical drawings and understand how they assist with creating real-life models which can be used in industry (as well as in the classroom setting)</p> <p>Using drafting tools to accurately construct technical drawings</p>	<p><u>Creating Drawings</u></p> <p>Create technical drawings with accuracy, which can lead to model production</p>	<p><u>Drafting Sketches</u> http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html</p> <p><u>Important Design Concepts</u> https://www.goshen.edu/art/design/concepts.html</p> <p><u>Line Types in Technical Drawings</u> https://www.youtube.com/watch?v=_t2NjPpsegE</p>
<p>Identify the types of careers available in drafting and related fields</p> <p>NJSLS: 9.3.12.AC.6</p> <p>CCTC: AC.1</p> <p>CCSS: .W.11-12.7</p>	<p>What are the possible career options for someone who wants to study drafting and or architecture?</p> <p>What is the salary and job outlook for drafting and architectural</p>	<p>Ability to research careers and report findings to a group in the form of a presentation</p> <p>Analyze different career paths, compare and contrast educational</p>	<p><u>Utilizing Occupational Handbook</u></p> <p>Utilize the Occupational Outlook Handbook to research job outlook, careers, and salary opportunities as it relates to drafting and architectural</p>	<p><u>Occupational Outlook handbook,</u></p> <p><u>US Bureau of Statistics</u></p>

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
	<p>careers?</p> <p>How are drafting and architecture related?</p>	<p>requirements to determine possible paths for college and life thereafter</p>	<p>landscaping, design, etc</p> <p>Reporting Findings Report research found in Occupational Handbook to the class as a group project</p>	
<p>Students will be able to create free hand sketches, sets of drawings, and turn them into accurate mechanical drawings</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>What is the difference between free hand sketches, sets of drawings, and mechanical drawings?</p> <p>How do the different types of drawings lead to the ultimate goal of constructing an industrial model?</p>	<p>Determine the difference between free hand sketches, sets of drawings, and mechanical drawings</p> <p>Have the ability to utilize drafting tools to complete the various types of drawings accurately</p>	<p>Provide students with a sample sketch and measurements, allow them to duplicate the sketch (grade based upon correct measurements and accuracy of drawing)</p> <p>Students will complete examples of freehand sketches, sets of drawings, and mechanical drawing over the course of the marking period</p>	<p>Free Hand Sketches http://ef.engr.utk.edu/ef101-2002/as/book/as_chap3.pdf</p> <p>Sketching Techniques https://www.youtube.com/watch?v=dmt6_n7Sgcg</p> <p>Mechanical Drawings Techniques https://www.youtube.com/watch?v=pgv3AUfZCBI</p>
<p>Explain the importance of models in industry</p> <p>NJSLS: 9.3.12.AC.6</p>	<p>What purpose do models serve?</p> <p>How much attention to</p>	<p>Application of drafting tools, and technical drawings and sketches to</p>	<p>Model Designing Activity</p> <p>Design real-life models</p>	<p>Creating Models in Industry https://www.teachengineering.org/activities/view/b</p>

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
<p>CCTC: AC-DES.6</p> <p>CCSS: W.11-12.7</p>	<p>detail should be in a model?</p> <p>Does a creating life-like model help industry?</p>	<p>create real- life models</p>	<p>of items that can utilizing in industrious settings (ex: model cars)</p>	<p>uild_a_scale_model</p>
<p>List and describe the four steps in the design model</p> <p>NJSLS: 9.3.12.AC-DES.6</p> <p>CCTC: AC-MO.1</p> <p>CCSS: W.11-12.10 G.CO.12</p>	<p>Compare the drafting design model to the scientific method, how are both methods used to create, research, and design experiments and models? How are drafting and science interrelated</p>	<p>Compare and contrast the steps of the scientific method and the drafting design model and apply the skills from both methods when creating models</p> <p>Applying the scientific method to solve problems in drafting.</p>	<p>Answering Open-Ended Students will answer Open-ended questions about the key functions of the scientific and drafting design methods.</p> <p>Students will create a Venn Diagram to illustrate the similarities and differences amongst the two methods</p>	<p>Steps of the Design Model in Engineering https://www.youtube.com/watch?v=4O0T0zt4o7c</p> <p>Engineering Design Process https://www.youtube.com/watch?v=ZQF8iU7ygoM</p>

Unit Vocabulary

Aerospace engineer
 Agricultural engineer
 Algorithms
 Architects
 Brainstorming
 Ceramic engineer
 Chemical engineer
 Checker
 Civil engineer
 Design
 Design drafter
 Design method
 Detail drafter
 Detailer
 Drafting
 Drafting trainee
 Electrical engineer

Heuristics
 Industrial engineer
 Industrial designer
 Landscape
 Architecture
 Layout drafter
 Mechanical drawings
 Mechanical engineer
 Metallurgical engineer
 Mockup
 Model
 Nuclear Engineer
 Petroleum engineer
 Problem
 Problem solving
 Prototype

Suggested Structured Learning Experiences

Students will visit the Center for Architecture to view the ways in which simple architectural designs are created. Students will get the opportunity to look and touch models and ask questions about the ways in which designs are developed and produced over time.

The Center for Architecture
536 Laguardia Place
NY, NY 10012
www.cfafoundation.org

Students will tour NJIT and attend architecture based classes in order to get an idea of what learning looks like at the college level. Students will interact with NJIT students by means of a question and answer session. Lastly, the program leader will inform students about the requirements needed for acceptance in the higher educational institute.

New Jersey Institute Of Technology
New Jersey School of Architecture
University Heights
Newark , NJ 07102
www.architecture.njit.edu

Suggested Unit Projects

Choose At Least One

Students will complete a PowerPoint presentation that compares the Scientific Method and the drafting design models to find out how both methods enable research and proof of evidence when researching implementation of design and model completion

Students will complete sketches and add them to a portfolio over the course of the academic school year. The sample drawings can be used to display designs they've created when applying to college.