Architectural Design

HIGH WAGE

HIGH SKILL

IN DEMAND

Office of the State Superintendent of Education
Postsecondary and Career Education Division
Career and Technical Education Department

Christina Grant, Ed.D.
State Superintendent of Education

Antoinette Mitchell, Ph.D.
Assistant Superintendent, Postsecondary and Career Education

Kilin Boardman-Schroyer
Deputy Assistant Superintendent, Postsecondary and Career Education

Richard W. Kincaid
State Director, Career and Technical Education

The purpose of this document is to communicate the required Career and Technical Education (CTE) academic standards for the Architectural Design Program of Study. The academic standards in this document are theoretical and performance-based. The standards contain content from Colorado, Maryland, Tennessee, and Texas and were validated by D.C. business and industry partners. All content is used with permission.

In addition to academic standards, OSSE has incorporated into this document Labor Market Information (LMI) definitions and explanations for the Program of Study; program aligned Industry Recognized Credentials; and Work-Based Learning resources and requirements by course level.

This document is intended for use by educational administrators and practitioners. A similar document is available for each state-approved CTE Program of Study.

Architectural Design

Table of Contents

Course Descriptions: Architectural Design		
Course Level	**Course Information**	**Description**
Level I	**Principles of Architecture** **OSSEID:** 5020101 **Grades:** 9-12 **Prerequisite:** None **Credit:** 1	Principles of Architecture provides an overview of the various fields of architecture, interior design, and construction management. Achieving proficiency in decision-making and problem-solving is an essential skill for career planning and lifelong learning. Students use self-knowledge, education, and career information to set and achieve realistic career and educational goals. Job-specific training can be provided through training modules that identify career goals in trade and industry areas. Classroom studies include topics such as safety, work ethics, communication, information technology applications, systems, health, environment, leadership, teamwork, ethical and legal responsibility, employability, and career development and include skills such as problem-solving, critical thinking, and reading technical drawings.
Level II	**Architectural Design I** **OSSEID:** 5020102 **Grades:** 10-12 **Prerequisite:** Principles of Architecture **Credit:** 1	In Architectural Design I, students will gain knowledge and skills needed to enter a career in architecture or construction or prepare a foundation toward a postsecondary degree in architecture, construction science, drafting, interior design, or landscape architecture. Architectural Design I includes the knowledge of the design, design history, techniques, and tools related to the production of drawings, renderings, and scaled models for nonresidential or residential architectural purposes.
Level III	**Architectural Design II** **OSSEID:** 5020103 **Grades:** 11-12 **Prerequisite:** Architectural Design I **Credit:** 1	In Architectural Design II, students will gain advanced knowledge and skills needed to enter a career in architecture or construction or prepare a foundation toward a postsecondary degree in architecture, construction science, drafting, interior design, or landscape architecture. Architectural Design II includes the advanced knowledge of the design, design history, techniques, and tools related to the production of drawings, renderings, and scaled models for nonresidential or residential architectural purposes.
Level IV	**Practicum in Architectural Design** **OSSEID:** 5020104 **Grades:** 12 **Prerequisite:** Architectural Design II **Credit:** 1	The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Architecture and Construction Career Cluster. Practicum in Architectural Design is an occupationally specific course designed to provide technical instruction in architectural design. Safety and career opportunities are included in addition to work ethics and architectural design study.

Industry Certifications

Autodesk Certified Professional (ACP) in Revit Architecture
USGBC LEED Green Associate
National Green Infrastructure Certification

Work-Based Learning Examples and Resources

Level I Course	Level II Course	Level III Course	Level IV Course
Career Exploration Industry Visits Guest Speakers Participate in a CTSO	**Career Awareness** *All of Level I, plus:* Postsecondary Visits Program-Specific Site Tours Mock Interviews	**Career Preparation** *All of Level I and II, plus:* Job Shadow Paid/Unpaid Internships	**Career Preparation** Paid/Unpaid Internships Apprenticeships

Several resources are available to help instructors meet the Level I and Level II WBL requirements, including:

Career Coach DC (http://careercoachdc.emsicc.com). Online site designed to help students find and connect to a career pathway by providing the most current local data on wages, employment, job postings, and associated education and training. The resource includes a Career Assessment for students.

Nepris (https://dc.nepris.com/). Connects educators and learners with a network of industry professionals virtually, bringing real-world relevance and career exposure to all students. Nepris also provides a skills-based volunteering platform for business and industry professionals to extend their educational outreach.

Virtual Job Shadow (https://virtualjobshadow.com). Provides interactive tools which empower students to discover, plan, and pursue their dreams. Rich video library presents a "day in the life of" view for thousands of occupations.

Labor Market Information Definitions and Data

Career and Technical Education programs of study in the District of Columbia must meet at least one of the High Wage, High Skill, and In-Demand definitions below to be considered appropriate for our students and the regional labor market. These definitions were created in collaboration with Career and Technical Education leaders from District of Columbia LEA's, the University of the District of Columbia Community College, and national guidance from Research Triangle International (RTI) and Education Northwest. Additionally, previous work was consulted from researchers at MIT's Labor Wage Index Project and the DC CTE Task Force's 2012 Strategic Plan for the District of Columbia.

Indicator	Definition	Data for the Architectural Design Program of Study (source: EMSI, August 2021)
High Wage	Those occupations that have a 25th percentile wage equal to or greater than the most recent MIT Living Wage Index for one adult in the District of Columbia, and/or leads to a position that pays at least the median hourly or annual wage for the Washington, DC, metropolitan statistical area. *Note: A 25th percentile hourly wage of $20.49 or greater is required to meet this definition.*	**Standard Occupational Code (SOC):** 17-1011.00. Architects, Except Landscape and Naval **Hourly Wages** **25th Percentile:** $34.69 **50th Percentile:** $45.61 **75th Percentile:** $58.48
High Skill	Those occupations located within the Washington, DC, metropolitan statistical area with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, or higher.	**Typical Entry-Level Education:** Bachelor's Degree
In-Demand	Those occupations in the Washington, DC, metropolitan statistical area having more than the median number of total *(growth plus replacement)* annual openings over a five-year period. *Note: An occupation is required to have an annual growth plus replacement rate of 105 openings, or greater, between 2020-25 to meet this definition.*	**Annual Openings:** 213

Model Six-Year Plan: ArchitecturalDesign

College: University of the District of Columbia Community College
Program/CIP:
Plan:

Entity: Office of the State Superintendent of Education
Career Cluster: Architecture and Construction
Program of Study: Architectural Design

Subject	High School				College			
	9th Grade	10th Grade	11th Grade	12th Grade	Semester I	Semester II	Semester III	Semester IV
English (4)	English I	English II	English III	English IV				
Math (4)	Algebra I	Geometry	Algebra II	Math				
Science (4)	Biology	Lab Science	Lab Science	Science				
Social Studies (4)	World History and Geography I: Middle Ages	World History and Geography II: Modern World	U.S. History	U.S. Government (.5) and D.C. History (.5)				
Health (.5) and Physical Ed (1)	Health (.5) Physical Ed (.5)	Physical Ed (.5)						
World Languages (2)			World Language I	World Language II				
Art (.5)		Art (.5)						
Music (.5)		Music (.5)						
Elective / Major Courses	Principles of Architecture	Architectural Design I	Architectural Design II	Practicum in Architectural Design				
Total possible college credits completed in high school: XX					**Credit hours required to complete the AAS program: XX**			

Course Standards

Principles of Architecture

1. **General requirements.** This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
    A. Career and technical education instruction provides students with industry-aligned content, challenging academic standards, and relevant technical knowledge to further their education and succeed in current or emerging professions.

    B. The Architecture and Construction Career Cluster focuses on designing, planning, managing, building, and maintaining the built environment.

    C. Principles of Architecture provides an overview of the various fields of architecture, interior design, and construction management. Achieving proficiency in decision-making and problem-solving is an essential skill for career planning and lifelong learning. Students use self-knowledge, education, and career information to set and achieve realistic career and educational goals. Job-specific training can be provided through training modules that identify career goals in trade and industry areas. Classroom studies include topics such as safety, work ethics, communication, information technology applications, systems, health, environment, leadership, teamwork, ethical and legal responsibility, employability, and career development and include skills such as problem-solving, critical thinking, and reading technical drawings.

    D. Students will participate in at least two Career Exploration Work-Based Learning experiences in this course, which might include guest speakers and workplace tours relevant to the program of study.

    E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
    A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
        a. identify employment opportunities, including entrepreneurship and preparation requirements, for careers in the architecture and construction cluster;
        b. demonstrate an understanding of group participation and leadership related to citizenship and career preparation;
        c. identify employers' expectations and appropriate work habits;
        d. apply the competencies related to resources, information, systems, and technology in appropriate settings and situations; and
        e. demonstrate knowledge of the concepts and skills related to health and safety in the workplace, as specified by appropriate governmental regulations.

B. **The student performs mathematical operations to complete tasks such as measuring and estimating materials and supplies. The student is expected to:**
  a. determine areas and volumes of various structures and estimate materials and supplies using appropriate geometric formulas and calculations;
     i. determine percentages and decimals and use percentages and decimals to perform measurement tasks using appropriate formulas and calculations;
  2. determine ratios, fractions, and proportions using appropriate formulas and calculations;
  3. perform measurement tasks using ratios, fractions, and proportions; and
  4. estimate materials and supplies using dimensions, spaces, and structures calculations.

C. **The student uses physics skills to work with materials and load applications. The student is expected to:**
  1. apply basic concepts of static and loads to planning; and
  2. identify the physical properties present when using common construction materials in order to use the materials safely, effectively, and efficiently.

D. **The student manages chemical materials safely. The student is expected to:**
  1. recognize the issues present when mixing compatible and incompatible substances to maintain workplace and job site safety;
  2. differentiate between incompatible and compatible substances;
  3. describe the chemical process that occurs when using common construction materials to maintain workplace and job site safety; and
  4. apply chemical processes in relation to environmental conditions.

E. **The student reads, comprehends, and communicates effectively in the workplace, using proper grammar and workplace terminology when using printed, written, and electronic media. The student is expected to:**
  1. use technological applications to transmit reports;
  2. develop written communications such as estimates, work orders, and memos;
  3. read and follow technical instructions and manuals;
  4. compose an accurate and organized diary or log of work; and
  5. write reports and documents such as estimates, permits, memos, and technical reports.

F. **The student listens attentively and speaks clearly to convey information correctly. The student is expected to:**
  1. confirm understanding of verbal and visual instructions; and
  2. ask relevant questions concerning details of instructions.

G. **The student listens to and speaks clearly with a variety of individuals to enhance communication skills. The student is expected to:**
  1. provide verbal instructions; and
  2. listen attentively to spoken messages to respond to information.

H. **The student exhibits public relations skills to address a variety of situations, such as increasing internal and external customer and client satisfaction. The student is expected to:**
  1. communicate effectively to develop positive customer and client relationships;
  2. develop and maintain customer relations;
  3. define customer and client satisfaction; and

4. evaluate customer and client satisfaction.

I. **The student identifies the relationship between available resources and requirements of a project to accomplish realistic planning. The student is expected to:**
   1. initiate a project, including identifying resources and materials and time-management, labor-management, job-management, and job-site obligations in order to effectively plan;
   2. plan a project, including estimating correct amounts of required resources and materials and identifying risks;
   3. evaluate the feasibility of alternative suggestions;
   4. execute, monitor, and control a project using available resources and materials effectively; and
   5. close a project, including identifying lessons learned and evaluating waste of resources and materials.

J. **The student evaluates and adjusts plans and schedules to respond to unexpected events and conditions. The student is expected to:**
   1. incorporate potential job disruptions into planning timelines;
   2. identify potential events and conditions that disrupt the completion of a job;
   3. solve situational problems involved with unexpected events and conditions;
   4. adjust plans and schedules to meet project needs;
   5. modify existing plans and schedules to reflect an unexpected change;
   6. identify and assess critical situations as they arise to resolve issues with the best solution; and
   7. present a project update to track changes necessitated by unexpected events and conditions.

K. **The student synthesizes and reports conditions to keep the organization appraised of progress and potential problems. The student is expected to:**
   1. provide a project update for stakeholders; and
   2. present a verbal or written status report on a project.

L. **The student uses technological applications specific to architecture and construction to access, manage, integrate, and create information. The student is expected to:**
   1. manage personal and professional schedules and contact information;
   2. manage daily, weekly, and monthly schedules using an application; and
   3. read and follow technical instructions and manuals;
   4. compose an accurate and organized diary or log of work; and
   5. write reports and documents such as estimates, permits, memos, and technical reports.

M. **The student uses electronic devices to communicate. The student is expected to:**
   1. access an electronic system using login and password functions;
   2. access electronic messages received;
   3. create electronic messages in accordance with established business standards such as grammar, word usage, spelling, sentence structure, clarity, and etiquette;
   4. practice appropriate electronic message etiquette;
   5. send electronic messages;
   6. use electronic devices to share files and documents;
   7. access electronic devices for attachments;
   8. attach documents to electronic messages; and

9. save electronic messages and attachments.

N. **The student uses writing and publishing applications. The student is expected to:**
   1. prepare simple documents and other business communications;
   2. retrieve existing documents;
   3. create documents such as letters, memos, and reports using existing forms and templates;
   4. safeguard documents using name and save functions;
   5. format text using basic formatting functions; and
   6. employ word processing utility tools such as spell check, grammar check, and thesaurus.

O. **The student uses spreadsheet applications. The student is expected to:**
   1. create, retrieve, edit, save, and print spreadsheets;
   2. perform calculations and analysis on data;
   3. group worksheets;
   4. create charts and graphs from a spreadsheet;
   5. perform calculations using simple formulas; and
   6. input and process data using spreadsheet functions.

P. **The student uses database applications. The student is expected to:**
   1. manipulate data elements;
   2. enter data using a form;
   3. locate and replace data using search and replace functions; and
   4. process data using database functions such as structure, format, attributes, and relationships.

Q. **The student uses collaborative applications. The student is expected to:**
   1. facilitate group work through the management of shared schedules and contact information;
   2. manage daily, weekly, and monthly schedules using an application; and
   3. maintain a shared database of contact information.

R. **The student complies with governmental regulations and applicable codes to establish a legal and safe environment. The student is expected to:**
   1. identify occupation-specific governmental regulations and national, state, and local building codes to establish appropriate regulations and codes;
   2. comply with governmental regulations and building codes;
   3. read and discuss information on Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), and other safety regulations; and
   4. read and discuss Safety Data Sheet (SDS) information to manage and dispose of hazardous materials.

S. **The student examines all aspects of the built environment and systems to complete project planning. The student is expected to:**
   1. align and incorporate the built environment and its systems to complete the project;
   2. label all systems on a set of construction documents;
   3. discuss the interrelationship of the systems in the built environment; and
   4. use a sequential method such as the critical path method so that work progresses efficiently.

T. **The student applies industry standards and practices to ensure quality work. The student is expected to:**
   1. identify current industry standards and practices in order to incorporate quality into projects;
   2. document how quality improves profitability;
   3. report on issues that affect quality;
   4. use industry standards and practices to enhance appreciation for quality workmanship; and
   5. perform work that meets or exceeds the quality standards of the industry.

U. **The student observes rules and regulations to comply with personal and occupational health and safety standards. The student is expected to:**
   1. follow appropriate safety standards to ensure a safe environment;
   2. practice safety rules and regulations;
   3. identify safety precautions and hazards to ensure a safe environment; and
   4. use appropriate safety practices and equipment, including personal protective equipment.

V. **The student works as an individual and as a team member to accomplish assignments. The student is expected to:**
   1. apply the five-stage Design Thinking model proposed by the Hasso-Plattner Institute of Design at Stanford, including Empathize, Define, Ideate, Prototype, and Test;
   2. understand the purpose of, and conduct, a charrette;
   3. use human relations skills to work cooperatively with coworkers representing different cultures, genders, and backgrounds;
   4. track team goals to contribute constructively and positively to the team;
   5. match team members to appropriate activities;
   6. manage skills to effectively accomplish assignments;
   7. effectively use conflict-resolution skills, such as negotiation, with customers and coworkers to maintain a smooth workflow; and
   8. use mentoring skills to inspire and motivate others to achieve and enhance performance.

W. **The student exhibits personal accountability, integrity, and responsibility to enhance confidence among coworkers. The student is expected to:**
   1. apply the professional and ethical standards of the industry to personal conduct;
   2. practice professional and ethical standards;
   3. maintain personal integrity;
   4. promote personal and professional integrity in coworkers; and
   5. recognize integrity in others.

X. **The student reads regulations and contracts to ensure ethical and safety elements are observed. The student is expected to:**
   1. study regulations and codes to identify those applicable to the local area;
   2. locate and implement regulations and codes applicable to tasks and projects;
   3. comply with local, state, and federal agencies and model code-setting organizations;
   4. recognize the definition of specialized words or phrases to fully understand documents and contracts;
   5. use industry jargon or terminology appropriately;
   6. use industry acronyms correctly;
   7. use words with multiple meanings correctly in context; and

8. use ethical and legal standards to avoid conflicts of interest.

Y.   **The student recognizes a positive work ethic to comply with employment requirements. The student is expected to:**
1. exhibit behaviors showing reliability and dependability;
2. recognize appropriate dress for the work environment; and
3. recognize the required employment forms and documentation such as I-9, work visa, W-4, and licensures to meet employment requirements.

Z.   **The student recognizes requirements for career advancement to plan for continuing education and training. The student is expected to:**
1. identify opportunities for career advancement to formulate career goals;
2. identify a career ladder;
3. develop a career advancement plan;
4. review progress of a career advancement plan;
5. maintain positive interpersonal skills to enhance advancement potential;
6. explore education and training opportunities to acquire skills necessary for career advancement;
7. list postsecondary educational paths associated with the architecture and construction trades, including college, apprenticeship, and specialty trade schools;
8. explore costs associated with postsecondary education;
9. participate in professional development opportunities such as professional organizations and associations, trade shows, and seminars;
10. read professional journals, magazines, manufacturers' catalogs, industry publications, and Internet sites to keep current on industry trends; and
11. identify declining and emerging occupations, practices, and procedures.

AA. **The student examines the organization and structure of various segments of the industry to prepare for career advancement. The student is expected to:**
1. recognize segments of the construction industry and show the relationships to specialty areas;
2. obtain necessary knowledge and skills to enhance employability;
3. research local and regional labor markets and job growth information to project potential for advancement;
4. identify sources of career information;
5. identify job opportunities for the trade;
6. identify organizations that offer career and job placement;
7. analyze potential growth of identified careers;
8. apply labor market and job growth information to career goals;
9. examine licensing, certification, and credentialing requirements at the national, state, and local levels to achieve compliance;
10. align licensing, certification, and credentialing requirements to career goals in order to plan for career advancement;
11. use technologies and resources to research licensing, certification, and credentialing;
12. evaluate and select suitable sources of licensing, certification, and credentialing;
13. identify licenses, certifications, and credentials applicable to career goals; and
14. document sources and agencies for licensing and certification and credentialing information, including contact information.

BB. **The student initiates and maintains a career portfolio to document knowledge, skills, and abilities. The student is expected to:**
1. select education, work history, and skills to create a personal resume;
2. develop a resume using word-processing technology;
3. contact professional references to acquire recommendations;
4. obtain appropriate letters of recommendation; and
5. document and maintain a record of work experiences, licenses, certifications, credentials, and education, and training to build a portfolio.

CC. **The student reads technical drawings and documents to plan a project. The student is expected to:**
1. interpret blueprints and drawings to assist with project planning;
2. recognize elements and symbols of blueprints and drawings;
3. relate information on blueprints to actual locations on the print;
4. recognize different classifications of drawings; and
5. interpret and use drawing dimensions.

DD. **The student uses and maintains appropriate tools, machines, and equipment to accomplish project goals. The student is expected to:**
1. select tools, machinery, and equipment to match requirements of the project;
2. safely operate tools, machinery, and equipment;
3. maintain and care for tools, machines, and equipment;
4. use tools, machines, and equipment productively and efficiently in alignment with industry standards;
5. identify sources of information concerning state-of-the-art tools, equipment, materials, technologies, and methodologies;
6. read current periodicals, industry publications, and manufacturers' catalogs; and
7. explore state-of-the-art tools, equipment, materials, technologies, and methodologies.

EE. **The student develops technology skills. The student is expected to:**
1. use technology as a tool to research, organize, evaluate, and communicate information;
2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage, integrate, evaluate, and create information to function in a knowledge economy successfully;
3. demonstrate using current and new technologies specific to the program of study, course, and/or industry; and
4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Architectural Design I

1. **General requirements.** This course is recommended for students in Grades 10-12. Prerequisite: Principles of Architecture. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. Career and technical education instruction provides students with industry-aligned content, challenging academic standards, and relevant technical knowledge to further their education and succeed in current or emerging professions.

   B. Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

   C. The Architecture and Construction Career Cluster focuses on designing, planning, managing, building, and maintaining the built environment.

   D. In Architectural Design I, students will gain the knowledge and skills needed to enter a career in architecture or construction or prepare a foundation toward a postsecondary degree in architecture, construction science, drafting, interior design, or landscape architecture. Architectural Design I includes the knowledge of the design, design history, techniques, and tools related to producing drawings, renderings, and scaled models for nonresidential or residential architectural purposes.

   E. Students will participate in at least two Career Awareness Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.

   F. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
      1. identify employment opportunities, including entrepreneurship and preparation requirements, in the field of architecture;
      2. demonstrate an understanding of group participation and leadership related to citizenship and career preparation;
      3. identify employers' expectations and appropriate work habits;
      4. apply the competencies related to resources, information, systems, and technology in appropriate settings and situations; and
      5. demonstrate knowledge of the concepts and skills related to health and safety in the workplace, as specified by appropriate governmental regulations.

B. **The student applies key cognitive skills and academic behaviors to the requirements of architectural studies. The student is expected to:**
    1. self-monitor learning needs and seek assistance when needed;
    2. practice study habits necessary to manage academic pursuits and requirements;
    3. strive for accuracy and precision;
    4. complete and master tasks;
    5. demonstrate effective verbal and written communication skills with individuals from varied cultures, including fellow workers, managers, and customers;
    6. complete work orders and related paperwork;
    7. estimate jobs, schedules, and practices related to legal restrictions;
    8. read and interpret appropriate architectural symbols, schematics, blueprints, work drawings, manuals, and bulletins; and
    9. apply descriptive geometry related to auxiliary views, revolutions, and intersections.

C. **The student knows the concepts and skills that form the technical knowledge of architectural design. The student is expected to:**
    1. demonstrate knowledge of architectural design principles;
    2. determine building code and zoning requirements for building types in a selected area; and
    3. demonstrate knowledge of the various grades and types of construction materials.

D. **The student knows the function and application of the tools, equipment, technologies, and materials used in architectural drawing. The student is expected to:**
    1. use the tools, materials, and equipment commonly employed in the field of architecture in a safe manner;
    2. handle and dispose of environmentally hazardous materials; and
    3. demonstrate knowledge of new and emerging technologies that may affect the field of architecture.

E. **The student applies the concepts and skills of the profession to simulated or actual work situations. The student is expected to:**
    1. use problem-solving skills to analyze a situation and identify a problem to be solved;
    2. break a complex problem into component parts that can be analyzed and solved separately;
    3. strive for accuracy and precision;
    4. work independently;
    5. work collaboratively;
    6. research an architectural project;
    7. design and present an effective architectural product;
    8. present a final architectural product for critique;
    9. apply architectural lettering techniques;
    10. develop preliminary sketches of a nonresidential or residential architectural design;
    11. use traditional technical architectural drafting techniques to create drawings;
    12. demonstrate through drawings the development of maximum efficiency of circulation within areas or rooms;
    13. develop a site plan using the maximum orientation of the building relative to views, sun, and wind direction;
    14. develop building designs to ensure compatibility between interior and exterior to enhance overall appearance;

1) draw schematic site plans, floor plans, building elevations, sections, perspectives, and character sketches from bubble diagrams;
2) draw scaled wall thickness plans, elevations, and sections;
3) develop details of floor and wall sections as required;
4) demonstrate knowledge of the Americans with Disabilities Act;
5) assemble an architectural design in three dimensions;
6) customize screen menus to fit specific problems or needs;
7) construct points, lines, and other geometric forms using accepted computer-aided design methods;
8) create a freehand simple one-point perspective;
9) use a computer system to create a bill of materials;
10) use a computer system to create and modify architectural drawings; and
11) plot architectural drawings for presentation.

F. **The student begins exploration, development, and organization of ideas from the surroundings. The student is expected to:**
1. begin illustrating ideas for architectural projects from direct observation, experiences, imagination; and
2. begin comparing and contrasting the use of architectural elements such as color, texture, form, line, space, value, and architectural principles such as emphasis, pattern, rhythm, balance, proportion, and unity in personal architectural projects and those of others using vocabulary accurately.

G. **The student begins expressing ideas through original architectural projects using a variety of media with appropriate skill. The student is expected to:**
1. create beginning visual solutions by elaborating on direct observation, experiences, and imagination;
2. create beginning designs for practical applications; and
3. demonstrate effective beginning use of architectural media and tools in design, drawing, painting, printmaking, and sculpture such as model building.

H. **The student demonstrates an understanding of architectural history and culture as records of human achievement from ancient Egypt to the present. The student is expected to:**
1. compare and contrast historical and contemporary styles, identifying general themes and trends;
2. describe general characteristics in architectural projects from a variety of cultures; and
3. compare and contrast career opportunities in architecture.

I. **The student makes beginning informed judgments about personal architectural projects and the architectural projects of others. The student is expected to:**
1. interpret, evaluate, and justify architectural artistic decisions in personal architectural projects; and
2. select and analyze original architectural projects, portfolios, and exhibitions by peers or others to form precise conclusions about formal qualities, historical and cultural contexts, intents, and meanings.

J. **The student makes informed career decisions that reflect career goals. The student is expected to:**
1. determine employment and entrepreneurial opportunities and preparation requirements in architecture and related fields;
2. propose short-term and long-term career goals;
3. describe technology used in architectural careers;

4. maintain a project portfolio that documents experience by using graphic or written documentation of architectural-related projects; and
5. develop a professional resume.

K. **The student applies communication, science, and mathematics knowledge and skills to architectural projects. The student is expected to:**
1. prepare professional communications, technical reports, and presentations;
2. apply mathematical equations; and
3. apply scientific principles and concepts.

L. **The student knows the concept of sustainability. The student is expected to:**
1. identify the nature of energy;
2. relate potential energy, kinetic energy, and heat energy to conservation;
3. create an energy model;
4. evaluate different methods of energy transfer;
5. recognize sustainable design as it relates to architectural design; and
6. define green architecture as related to the field of architecture.

M. **The student develops technology skills. The student is expected to:**
1. use technology as a tool to research, organize, evaluate, and communicate information;
2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage, integrate, evaluate, and create information to function in a knowledge economy successfully;
3. demonstrate using current and new technologies specific to the program of study, course, and/or industry; and
4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Architectural Design II

1. **General requirements.** This course is recommended for students in Grades 11 and 12. Prerequisites: Architectural Design I. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. Career and technical education instruction provides students with industry-aligned content, challenging academic standards, and relevant technical knowledge to further their education and succeed in current or emerging professions.

   B. The Architecture and Construction Career Cluster focuses on designing, planning, managing, building, and maintaining the built environment.

   C. In Architectural Design II, students will gain advanced knowledge and skills needed to enter a career in architecture or construction or prepare a foundation toward a postsecondary degree in architecture, construction science, drafting, interior design, or landscape architecture. Architectural Design II includes the advanced knowledge of the design, design history, techniques, and tools related to producing drawings, renderings, and scaled models for nonresidential or residential architectural purposes.

   D. Students will participate in a Career Preparation Work-Based Learning experience in this course, which might include paid or unpaid internship experiences relevant to the program of study.

   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
      1. identify employment opportunities, including entrepreneurship and preparation requirements, in the field of architecture;
      2. demonstrate an understanding of group participation and leadership related to citizenship and career preparation;
      3. identify employers' expectations and appropriate work habits;
      4. apply the competencies related to resources, information, systems, and technology in appropriate settings and situations; and
      5. demonstrate knowledge of the concepts and skills related to health and safety in the workplace, as specified by appropriate governmental regulations.

   B. **The student relates core academic skills to the requirements of architecture. The student is expected to:**
      1. demonstrate effective verbal and written communication skills with individuals from varied cultures, including fellow workers, managers, and customers;
      2. complete work orders and related paperwork;
      3. estimate jobs, schedules, and standard industry practices related to legal restrictions;
      4. read and interpret architectural symbols, schematics, blueprints, work drawings, manuals, and bulletins; and
      5. apply descriptive geometry related to auxiliary views, revolutions, and intersections.

C. **The student knows the concepts and skills that form the technical knowledge of architectural computer-aided drafting. The student is expected to:**
   1. demonstrate knowledge of architectural design principles;
   2. determine building code and zoning requirements for building types in a selected area; and
   3. demonstrate knowledge of the various grades and types of construction materials.

D. **The student knows the function and application of the tools, equipment, technologies, and materials used in architectural computer-aided design. The student is expected to:**
   1. use the tools, materials, and equipment commonly employed in the field of architectural computer-aided design in a safe manner;
   2. handle and dispose of environmentally hazardous materials used in the field of architecture in accordance with the material safety data sheet (MSDS), the Occupational Safety and Health Administration (OSHA), and the Environmental Protection Agency (EPA) regulations; and
   3. demonstrate knowledge of new and emerging technologies that may affect the field of architecture.

E. **The student applies the concepts and skills of the trade to simulated and actual work situations. The student is expected to:**
   1. use problem-solving skills to analyze a situation to identify a problem to be solved;
   2. break a complex problem into component parts that can be analyzed and solved separately;
   3. strive for accuracy and precision;
   4. work independently;
   5. work collaboratively;
   6. research an architectural project;
   7. design and present an effective architectural product;
   8. present a final architectural product for critique;
   9. apply architectural lettering techniques;
   10. develop preliminary sketches of a residential plan or nonresidential plan;
   11. demonstrate through drawings the development of maximum efficiency of circulation within areas or rooms;
   12. develop a site plan using maximum orientation of the building relative to views, sun, and wind direction;
   13. draw building designs and styles to ensure compatibility between interior and exterior to enhance overall appearance;
   14. draw schematic site plans, floor plans, roof plans, building elevations, sections, perspectives, and character sketches using design development techniques;
   15. draw scaled wall thickness plans, interior elevations, and sections;
   16. develop details, sections, floor and wall sections, ceiling and roof sections, door and window sections, and other sections as required;
   17. assemble an architectural design in three dimensions;
   18. research the Green Building Rating System as defined by the U.S. Green Building Council; and
   19. create a project demonstrating sustainable design as it relates to architectural design as defined by the U.S. Green Building Council.

F. **The student applies the concepts and skills of the trade to simulated and actual work situations. The student is expected to:**
1. customize screen menus to fit specific problems or needs;
2. construct architectural drawings using advanced computer-aided design drafting skills;
3. create two- or three-point perspectives;
4. create three-dimensional solid models;
5. view three-dimensional objects in several different positions;
6. use a computer system to create a bill of materials;
7. use a computer-aided drafting system to create and modify nonresidential or residential architectural drawings;
8. plot architectural drawings for presentation; and
9. render three-dimensional objects with applied materials.

G. **The student describes the importance of teamwork, leadership, integrity, honesty, work habits, and organizational skills. The student is expected to:**
1. describe how teams function;
2. use teamwork to solve problems;
3. distinguish between the roles of team leaders and team members;
4. identify characteristics of good leaders;
5. identify employers' expectations and appropriate work habits;
6. define discrimination, harassment, and inequality;
7. use time-management techniques to develop and maintain work schedules and meet deadlines; and
8. complete work according to established criteria.

H. **The student sustains exploration, development, and organization of ideas from their surroundings. The student is expected to:**
1. use advanced skills to illustrate ideas for architectural projects from direct observation, experiences, and imagination; and
2. use advanced skills comparing and contrasting the use of architectural elements such as color, texture, form, line, space, and value and architectural principles such as emphasis, pattern, rhythm, balance, proportion, and unity in personal architectural projects and those of others using vocabulary accurately.

I. **The student uses advanced skills expressing ideas through original architectural projects using various media with appropriate skill. The student is expected to:**
1. create, using advanced skills, visual solutions by elaborating on direct observation, experiences, and imagination;
2. create, using advanced skills, designs for practical applications; and
3. demonstrate, using advanced skills, effective use of architectural media and tools in design, drawing, painting, printmaking, and sculpture such as advanced model building.

J. **The student demonstrates an understanding of architectural history and culture as records of human achievement by examining the connections between twentieth and twenty-first-century architecture and art and connections between Greek and Roman architecture and art. The student is expected to:**
1. compare and contrast historical and contemporary styles by identifying general themes and trends;
2. describe general characteristics in architectural artworks from a variety of cultures; and

3. compare and contrast career opportunities in architecture.

K. **The student makes advanced, informed judgments about personal architectural projects and the architectural projects of others. The student is expected to:**
   1. interpret, evaluate, and justify architectural, artistic decisions in personal architectural artworks; and
   2. select and analyze original architectural artworks, portfolios, and exhibitions by peers and others to form precise conclusions about formal qualities, historical and cultural contexts, intents, and meanings.

L. **The student exhibits employability skills that lead to job success in the architectural design industry. The student is expected to:**
   1. demonstrate effective verbal, nonverbal, written, and electronic communication skills;
   2. demonstrate effective methods to secure, maintain, and terminate employment;
   3. demonstrate positive interpersonal skills, including conflict resolution, negotiation, teamwork, and leadership;
   4. evaluate the relationship of good physical and mental health to job success and achievement;
   5. demonstrate appropriate grooming and appearance for the workplace;
   6. demonstrate appropriate business and personal etiquette in the workplace;
   7. exhibit productive work habits and attitudes; and
   8. maintain a project portfolio that documents architectural projects using a variety of multimedia techniques.

k) **The student develops technology skills. The student is expected to**:
   1. use technology as a tool to research, organize, evaluate, and communicate information;
   2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage, integrate, evaluate, and create information to function in a knowledge economy successfully;
   3. demonstrate using current and new technologies specific to the program of study, course, and/or industry; and
   4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Practicum in Architectural Design

1. **General requirements.** This course is recommended for students in Grade 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Architecture and Construction Career Cluster. Prerequisite: Architectural Design II. Students shall be awarded one credit for successful completion of this course.

2. **Introduction.**
   A. Career and technical education instruction provides students with industry-aligned content, challenging academic standards, and relevant technical knowledge to further their education and succeed in current or emerging professions.

   B. The Architecture and Construction Career Cluster focuses on designing, planning, managing, building, and maintaining the built environment.

   C. Practicum in Architectural Design is an occupationally specific course designed to provide technical instruction in architectural design. Safety and career opportunities are included in addition to work ethics and architectural design study.

   D. Students will participate in a Career Preparation Work-Based Learning experience in this course, which includes paid or unpaid internship, pre-apprenticeship, or apprenticeship experiences relevant to the program of study.

   E. Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

3. **Knowledge and skills.**
   A. **The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:**
      1. identify employment opportunities, including entrepreneurship and preparation requirements, for the student's chosen field;
      2. demonstrate an understanding of group participation and leadership related to citizenship and career preparation;
      3. demonstrate productive work habits and attitudes;
      4. apply the competencies related to resources, information, interpersonal skills, systems, and technology in appropriate settings and situations; and
      5. demonstrate knowledge of the concepts and skills related to health and safety in the workplace, as specified by appropriate governmental regulations.

   B. **The student relates communication, mathematics, and science to the requirements of the student's chosen field. The student is expected to:**
      1. demonstrate effective verbal and written communication skills with individuals from varied cultures, including fellow workers, managers, and customers;
      2. apply mathematics principles and practices;
      3. apply and identify scientific principles used in projects; and

4. read and interpret appropriate schematics, charts, graphs, drawings, construction documents, directions, manuals, bulletins, and regulations.

C. **The student knows the function and application of the tools, equipment, technologies, and materials used in the student's chosen field. The student is expected to:**
   1. identify and select basic materials and processes used in the student's chosen field;
   2. use the tools and equipment commonly employed in the student's chosen field in a safe manner;
   3. handle and dispose of environmentally hazardous materials used in the student's chosen field in a proper manner; and
   4. demonstrate knowledge of new and emerging technologies in the student's chosen field.

D. **The student selects and uses multimedia communication and rendering technology to meet specific architectural design needs. The student is expected to:**
   1. apply multimedia communication and rendering technology to individual or community problems;
   2. describe the factors that affect the use and interpretation of communication products; and
   3. identify and describe the roles of communication such as informing, persuading, and educating.

E. **The student designs multimedia communication and rendering products using appropriate architectural design processes and techniques. The student is expected to:**
   1. develop or improve communication products that meet specified needs; and
   2. maintain a project portfolio that documents architectural projects using a variety of multimedia techniques.

F. **The student produces multimedia communication and rendering products using the appropriate tools, equipment, machines, materials, and processes. The student is expected to:**
   1. use a variety of tools, equipment, and machines; and
   2. produce an architectural project using multimedia communication techniques.

G. **The student follows appropriate codes, laws, standards, or regulations. The student is expected to:**
   1. identify areas where codes, laws, standards, or regulations may be required;
   2. locate the appropriate codes, laws, standards, or regulations; and
   3. comply with the appropriate codes, laws, standards, or regulations.

H. **The student demonstrates the ability to solve problems, think critically, and make decisions. The student is expected to:**
   1. develop or improve a product by following a problem-solving strategy;
   2. apply critical-thinking strategies to the analysis and evaluation of proposed technological solutions; and
   3. apply decision-making techniques.

I. **The student applies communication, mathematics, and science knowledge and skills to job-related activities. The student is expected to:**
   1. apply written, verbal, and visual communication techniques consistent with industry standards;
   2. use mathematics concepts in communication technology; and
   3. identify and apply scientific principles.

J. **The student determines employment opportunities and preparation requirements for careers in the field of architecture. The student is expected to:**
1. determine preparation requirements for various levels of employment in a variety of careers;
2. analyze the future employment outlook;
3. describe entrepreneurial opportunities in architecture and related fields;
4. determine how interests, abilities, personal priorities, and family responsibilities affect career choice;
5. compare rewards and demands for various levels of employment in a variety of careers; and
6. determine continuing education opportunities that enhance career advancement and promote lifelong learning.

K. **The student demonstrates ethical and legal practices for careers in the architectural-related workplace. The student is expected to:**
1. summarize the rights and responsibilities of employers and employees;
2. exhibit ethical practices as defined by the architectural industry;
3. analyze legal aspects of the architectural-related workplace;
4. develop a school-based learning activity in collaboration with the teacher and at least one related mentor that provides an in-depth study of at least one aspect of a selected business, industry, and labor independent study;
5. present the project in at least two formats such as model, graphic, verbal, or written to a panel of students, teachers, and practitioners in the career concentration;
6. maintain a project portfolio that documents experience by using graphic or written documentation of architectural-related projects; and
7. develop and update a professional resume that includes appropriate education history, work history, professional references, letters of recommendation, and all relevant information for any licenses, certifications, and credentials.

L. **The student develops technology skills. The student is expected to:**
1. use technology as a tool to research, organize, evaluate, and communicate information;
2. use digital technologies (computers, PDAs, media players, GPSs, etc.); communication/networking tools, and social networks appropriately to access, manage, integrate, evaluate, and create information to function in a knowledge economy successfully;
3. demonstrate using current and new technologies specific to the program of study, course, and/or industry; and
4. apply a fundamental understanding of the ethical/legal issues surrounding the access and use of information technologies.

Equipment List: Architectural Design

25 computers (with adequate memory to operate Autodesk software)	Model building supplies (bass wood, balsa wood, foam board)
Autodesk Revit Licenses	Notebooks
3D printer (optional)	Parallel bars and accessories
Architect's scales	Pencils
Blade refills	Printer
CAD software programs	Printer ink
Chairs, adjustable, to match desks	Printer, large format
Compasses	Interactive Whiteboard (optional)
Cutting mats	Scanner
Dial calipers	Surveying equipment
Digital camera	Triangle sets
Drafting desks	Tripod
Drafting paper	USB flash drives
Drafting tool storage cabinet	Utility knifes
Electric Pencil sharpeners	Triangle sets
Engineer's scale	Tripod
Eraser shield	USB flash drives
Erasers	Utility knifes
Glue	Tripod
Headphones for computers	USB flash drives
Hot glue guns	Utility knifes