



Program of Study Guide:

Architectural Design and Drafting

Comprehensive guidelines and course standards for the
Architecture Design and Drafting pathway

Office of College and Career Pathways

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MARYLAND STATE DEPARTMENT OF EDUCATION

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Purpose

The purpose of this document is to communicate the required Career and Technical Education (CTE) academic standards for the Architectural Design and Drafting Program of Study. The academic standards in this document are theoretical and performance based. The standards contain content from multiple state departments of education, industry related resources and have been reviewed and vetted by members of the Maryland business and industry community.

In addition to academic standards, the Maryland State Department of Education (MSDE) 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.

Standards Sources

The following sources collectively support a progression of standards from foundational to advanced design concepts in a high school context, preparing students for industry-aligned certifications like AutoDesk Revit Certified User and LEED Green Associate, providing them with the necessary knowledge and skills for career readiness in architectural design fields.

1. MSDE's OCCP Construction and Development eCommunity

- A. **Description:** This curriculum is curated by CTE affiliates to support Architecture and Construction Management courses.
- B. **Use:** These courses could be used to support instruction across this program.
- C. **Source:** Access can be attained through the MSDE Canvas site.

2. ASCENT's Autodesk Revit Architecture Fundamentals

- A. **Description:** Official Autodesk Authorized Publisher providing structured learning materials developed in collaboration with Autodesk.
- B. **Use:** Directly aligns with standards in course 1 and course 2, providing systematic instruction for Revit certification preparation.
- C. **Source:** Available through ASCENT's education portal (ascented.com) or authorized Autodesk resellers.

3. Architecture: Form, Space, and Order by Francis D.K. Ching

- A. **Description:** Foundational architectural design textbook used in professional architecture programs worldwide.
- B. **Use:** Supports standards in course 1, providing fundamental understanding of architectural principles, sketching, and visualization.
- C. **Source:** Available through major educational publishers and book retailers (Wiley Publishing).

4. USGBC Learning Hub

- A. **Description:** Educational platform from the U.S. Green Building Council offering sustainable design curriculum.
- B. **Use:** Supports standards in course 2, providing real-world applications of sustainable design principles and energy analysis.
- C. **Source:** Accessible through learning.usgbc.org with educational institution membership.

5. Autodesk Certified User Official Exam Prep

- A. **Description:** Official certification preparation materials from Certiport/Autodesk.
- B. **Use:** Directly supports course 2 standards, providing practice exams and learning materials aligned with certification requirements.
- C. **Source:** Available through Certiport's academic portal (certiport.com).

6. Project Lead The Way (PLTW) Civil Engineering and Architecture

- A. **Description:** Comprehensive high school engineering curriculum with hands-on projects.
- B. **Use:** Supports both courses' standards through integrated projects that combine architectural design, BIM, and sustainable practices.
- C. **Source:** Available through PLTW partnership program (pltw.org).

7. SkillsUSA Architectural Drafting Resources

- A. **Description:** Competition-based curriculum materials aligned with industry standards.
- B. **Use:** Supports advanced documentation and presentation standards in all courses through real-world project scenarios.
- C. **Source:** Accessible through SkillsUSA professional membership (skillsusa.org).

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

Course Descriptions

Course Level	Course Information	Description
Required Core: Course 1	Architectural Design Principles SCED: Pending Grades: 9-12 Prerequisite: None Credit: 1	This course introduces students to fundamental architectural principles and basic drafting techniques. Students learn to use traditional drafting tools and begin working with computer-aided design software while studying architectural history and basic building systems. Through hands-on projects, students develop basic model-making skills and learn shop safety while beginning to explore sustainable design concepts. The course emphasizes development of spatial thinking and basic visualization skills through both hand sketching and digital tools.
Required Core: Course 2	Architectural Design I SCED: Pending Grades: 10-12 Prerequisite: Architectural Design Principles Credit: 1	This course builds upon basic skills to develop proficiency in Building Information Modeling using Autodesk Revit. Students create detailed digital building models, produce construction documentation, and learn about building codes and cost estimation. The course includes advanced model-making using digital fabrication tools and prepares students for the Autodesk Revit Certified User exam. Students develop technical proficiency while learning to coordinate building systems and create professional documentation.
Optional Flex: Course 1	Architectural Design II SCED: Pending Grades: 11-12 Prerequisite: Architectural Design I Credit: 1	This course focuses on environmentally responsive design strategies and integrated building systems. Students learn to use energy modeling software and environmental analysis tools to optimize building performance. The course includes study of mechanical, electrical, and plumbing systems while introducing LEED certification concepts. Students conduct site analyses, perform daylight studies, and develop sustainable design solutions through detailed technical documentation.

Course Level	Course Information	Description
Optional Flex: Course 2	Career Connected Learning I SCED: Pending Grades: 11-12 Prerequisite: See Course Description Credits: 1-3	Prerequisites: 1. Alignment to the student's 6-Year Plan 2. Completion of: a. Minimum two sequential courses in a CTE pathway, OR b. Minimum two years of the same world language; OR c. Minimum two sequential courses in a comprehensive arts program; OR d. Inclusion in the IEP/504 transition plan with supporting documentation (as required) 3. Endorsement from an educator, mentor, employer, or career coach 4. No more than one course recovery credit in core subjects is needed by the student. This flexible, work-based learning course introduces students to real-world applications of classroom knowledge and technical skills through on-the-job experiences and reflective practices. Students engage in career exploration, skill development, and professional networking by participating in youth apprenticeships, registered apprenticeships, pre-apprenticeships, internships, capstone projects, or other approved career-connected opportunities. Variable credit (1–3) accommodates the required on-the-job training hours and related instruction. By integrating industry standards, employability skills, and personalized learning goals, Career Connected Learning I equips students to make informed career decisions, develop a professional portfolio, and build a strong foundation for success in postsecondary education, training, or the workforce.
Optional Flex: Course 3	Career Connected Learning II SCED: Pending Grades: 11-12 Prerequisite: Career Connected Learning I Credits: 1-3	Building on the foundational experiences of Career Connected Learning I, this advanced work-based learning course provides students with deeper on-the-job practice, leadership opportunities, and refined career exploration. Students continue to enhance their technical and professional skills, expanding their industry networks and aligning personal goals with evolving career interests. Variable credit (1–3) remains aligned with the required training hours and related instruction.

Course Level	Course Information	Description
		Through elevated responsibilities and skill application, Career Connected Learning II prepares students to confidently transition into higher-level postsecondary programs, apprenticeships, or the workforce.

Dual Enrollment and Career Connected Learning Experiences Must be Aligned to the CTE Core.

Industry-Recognized Credentials and Career-Connected Learning

The Blueprint for Maryland’s Future and the High School Level of a Registered Apprenticeship

The Maryland State Department of Education recognizes the high-school level of a Registered Apprenticeship (RA), defined as a State-approved Registered Apprenticeship begun during high school in which students complete at least 144 hours of related technical instruction and 250 hours of paid on-the-job training before graduation, with the remaining required apprenticeship hours completed post-graduation, as the gold standard of Career Connected Learning.

The CTE Committee of the Governor’s Workforce Development Board, in alignment with federal apprenticeship standards, requires 144 hours of RTI for all high school RA participants, and the Apprenticeship Maryland Program (AMP) defines the minimum RTI as **one course credit equivalent**. This high-school-level Registered Apprenticeship is the preferred career-connected learning option for students to meet the Blueprint’s goal that 45% of public high school graduates complete either the high-school level of a Registered Apprenticeship or another industry-recognized credential.

To the extent practicable, the greatest number of students should achieve this goal through participation in a high-school level Registered Apprenticeship, with schools ensuring these requirements are scheduled, completed, and documented for transcript and reporting purposes.

To the extent practicable, the greatest number of students should achieve this goal through the high-school level of a Registered Apprenticeship.

Career-Connected Learning Resources		
Course 1: Career Awareness	Course 2: Career Preparation	Flex Courses: Career-Connected Learning
- Industry Visits - Guest Speakers - Participation in Career and Technical Student Organizations - Postsecondary Visits – Program Specific Site Tours - Mock Interviews	- All of Career Awareness plus the following: - Job Shadow - Employer Mentoring	- Registered Apprenticeship - Internship - School-Based Enterprise - Employer-Directed Capstone

Industry-Recognized Credentials

By the end of Architectural Design I: AutoDesk Certified User: Revit, AutoCAD

Optional Credentials (via the Flex Course options): preparing for LEED Green Associate Credential

Labor Market Information: Definitions and Data

Labor market information (LMI) plays a crucial role in shaping Career and Technical Education (CTE) programs by providing insights into industry demands, employment trends, and skills gaps. This data helps education leaders assess the viability of existing programs and identify opportunities for new offerings. By aligning CTE programs with real-time labor market needs, schools can better prepare students for in-demand careers and ensure that resources are effectively utilized to support pathways that lead to high-quality, sustainable employment.

Standard Occupational Code (SOC) and Aligned Industry:

Indicator	Definition	Pathway Labor Market Data
High Wage¹	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 state of Maryland, and/or leads to a position that pays at least the median hourly or annual wage for the DC-VA-MD-WV Metropolitan Statistical Area (MSA). <i>Note: A 25th percentile hourly wage of \$24.74 or greater is required to meet this definition.</i>	Standard Occupational Code 17-1011: Architects, Except Landscape and Naval 17-3011: Architectural and Civil Drafters 17-3019: Drafters (All Other) Hourly Wage/Annual Salary 25 th Percentile: \$32.76 /\$68,149 50 th Percentile: \$41.06 /\$85,414 75 th Percentile: \$51.63 /\$107,388
High Skill	Those occupations located within the DC-VA-MD-WV Metropolitan Statistical Area (MSA) with the following education or training requirements: completion of an apprenticeship program; completion of an industry-recognized certification or credential; associate's degree, bachelor's degree, or higher.	Typical Entry-Level Education Associate's degree
In-Demand	Annual growth plus replacement, across all Maryland occupations, is <u>405</u> openings between 2024-2029.	Annual Openings 240

Lightcast Data Updated August 2025

¹ Living Wage Calculator: <https://livingwage.mit.edu/states/24>

Labor Market Information Data Source

Lightcast occupation employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates are also affected by county-level Lightcast earnings by industry. Foundational data for the state of Maryland is collected and reported by the Maryland Department of Labor.

Methodology for High Wage Calculations

To combine labor market data across multiple Standard Occupational Classifications (SOCs), a weighted average approach was used to ensure accurate representation of the marketplace. Median wages for each SOC were weighted based on their respective employment levels, reflecting the relative demand for each occupation. This method ensures that occupations with higher employment contribute proportionately to the overall wage calculation. Additionally, job openings from all relevant SOCs were summed to determine the total projected demand. For example, if Mechanical Engineers account for 67% of total employment and Electrical Engineers for 33%, their respective wages are weighted accordingly, and job openings are aggregated to provide a comprehensive view of labor market opportunities. This approach delivers a balanced and accurate representation of both wages and employment demand for the program.

Methodology for In-Demand Calculations

The baseline for annual job openings, taking into account new positions and replacement positions, was determined by taking the average of all annual job openings between 2024 and 2029 across all 797 career sectors at the 5-digit SOC code level. For the 2024-2029 period, average job openings (growth + replacement) is 405.

Course Standards: Architectural Design Principles

1. GENERAL REQUIREMENTS. This course is recommended for students in Grades 9-12.

2. INTRODUCTION

- A. Career and Technical Education (CTE) 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.
- B. The Construction Career Cluster prepares students for careers in designing, planning, and building sustainable infrastructure. This field includes architects, engineers, construction managers, and skilled trades professionals.
- C. The Architecture Design and Drafting program prepares students for careers in architecture, engineering, and construction management through a comprehensive four-year sequence. Students develop skills in both traditional and digital drafting techniques, building design, sustainable practices, and professional documentation. Starting with fundamental drawing and design principles, students' progress to advanced Building Information Modeling (BIM) using industry-standard software like AutoCAD and Revit. The program emphasizes sustainable design practices and culminates in opportunities to earn both Autodesk Revit Certified User and LEED Green Associate certifications. Through hands-on projects, students learn to use professional tools and equipment including drafting tools, 3D printers, laser cutters, and environmental testing equipment while developing a professional portfolio.
- D. Architectural Design Principles introduces students to fundamental architectural principles and basic drafting techniques. Students learn to use traditional drafting tools and begin working with computer-aided design software while studying architectural history and basic building systems. Through hands-on projects, students develop basic model-making skills and learn shop safety while beginning to explore sustainable design concepts. The course emphasizes development of spatial thinking and basic visualization skills through both hand sketching and digital tools.
- E. Students will participate in at least two Career-Connected Education and 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 through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. KNOWLEDGE AND SKILLS

- A. The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
 - 1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
 - 2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
 - 3. Employ effective reading, writing, and technical documentation skills.
 - 4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.

5. Demonstrate leadership skills and collaborate effectively as a team member.
6. Implement safety procedures, including proper handling of tools, equipment and hardware and following appropriate safety measures in the lab/shop environment.
7. Exhibit an understanding of legal and ethical responsibilities in the architectural field, following accessibility laws and best practices for design.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. The student identifies various career pathways in the Architectural Design and Drafting field.

The student is expected to:

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in architectural design.
2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in drafting and architectural design.

C. The student develops technology and digital literacy skills. The student is expected to:

1. Use technology as a tool for research, organization, communication, and problem-solving.
2. Use digital tools, including computers, mobile devices, collaboration platforms, and cloud services, to access, manage, and create information.
3. Demonstrate proficiency in using emerging and industry-standard technologies, including virtualization tools, design software, and related equipment. School systems, based on feedback from their business partners, could consider software such as TinkerCAD, AutoCAD, Revit, and Onshape, for scaffolded classroom implementation, and ultimately industry recognized certification.
4. Understand ethical and legal considerations for technology use, including the principles of data protection, copyright, and responsible technology use.

D. The student integrates core academic skills into architectural design practices. The student is expected to:

1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards.
2. Apply foundational mathematical concepts including scale and proportion calculations, geometric constructions, basic algebra for dimensional calculations, measurement conversions between imperial and metric systems, and area calculations for basic architectural spaces and building footprints.
3. Understand basic scientific principles including forces acting on simple structures, properties of common building materials, fundamentals of light and shadow in architectural spaces, and environmental factors affecting site planning and building orientation.

E. The student understands fundamental architectural design principles and elements. The student is expected to:

1. Define the basic elements and principles of architectural design including form, space, scale, and proportion.
2. Analyze historical architectural styles and their influence on modern design.
3. Apply basic design principles in creating simple architectural sketches and drawings.
4. Explain the relationship between human factors and architectural design with respect to how different spaces accommodate human activities and movement.

5. Create basic architectural diagrams showing spatial relationships and circulation patterns through bubble diagrams and basic floor plan sketches.

F. The student develops proficiency in basic drafting and visualization techniques. The student is expected to:

1. Demonstrate proper use and identify purpose of manual drafting tools and equipment.
2. Demonstrate understanding of drafting fundamentals such as orthographic projection, dimensioning, perspective drawings, and basic annotation.
3. Understand how to create basic architectural drawings including floor plans, elevations, and sections using manual drafting techniques with appropriate architectural scales and dimensions.
4. Construct physical architectural models using basic materials like cardboard and foam board while maintaining precise measurements and clean craftsmanship.

G. The student demonstrates foundational understanding of digital design software. The student is expected to:

1. Identify basic interface elements, such as the ribbon, project browser, properties palette, and navigation controls within architectural design software.
2. Use fundamental drawing tools—including lines, rectangles, and offset—and basic modification tools such as move, copy, and rotate to create simple geometry.
3. Place basic architectural elements—such as walls, doors, and windows—using default library components in architectural design software.
4. Navigate between 2D and 3D views, and operate zoom, pan, and other view tools to explore digital models.
5. Set up reference levels and grids to organize a basic project.
6. Initiate a new project using provided templates and configure project settings, including units and discipline.
7. Create basic sheets, place plan or elevation views, and output these to print or PDF.
8. Annotate drawings with simple dimensions and text notes to communicate essential information.

H. The student comprehends basic building systems and components. The student is expected to:

1. Identify primary building systems and their functions.
2. Describe basic structural systems and components such as loads, forces, and building stability.
3. Compare different construction materials and identify modern, industry aligned, implementation practices.
4. Identify basic mechanical and electrical symbols in architectural drawings and explain their meaning.

I. The student applies safe practices in the learning environment. The student is expected to:

1. Demonstrate proper safety procedures in tool and equipment operation by passing safety tests and consistently following protocols during lab activities.
2. Identify potential safety hazards in the architectural/engineering environment and describe mitigation protocols.
3. Maintain a safe and organized workspace by properly storing tools, maintaining clean work areas, and following cleanup procedures.

J. The student understands introductory sustainable design concepts. The student is expected to:

1. Define sustainable design and its importance in architecture.

2. Identify basic principles of environmental design and the impact of building orientation, natural lighting, and passive ventilation strategies have on energy use.
3. Create preliminary site analysis drawings that document environmental factors including sun paths, prevailing winds, and natural features.

K. The student develops a professional portfolio. The student is expected to:

1. Create a digital and/or physical organizational system for collecting and categorizing project work throughout the course.
2. Document the design process for each project through sketches, drawings, photographs, and written descriptions.
3. Select and present best work examples that demonstrate understanding of architectural design principles and technical skills.
4. Write project descriptions that clearly communicate design intent and process.

Course Standards: Architectural Design I

1. **GENERAL REQUIREMENTS.** This course is recommended for students in Grades 10-12.
2. **INTRODUCTION**
 - A. Career and Technical Education (CTE) 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.
 - B. The Construction Career Cluster prepares students for careers in designing, planning, and building sustainable infrastructure. This field includes architects, engineers, construction managers, and skilled trades professionals.
 - C. The Architecture Design and Drafting program prepares students for careers in architecture, engineering, and construction management through a comprehensive four-year sequence. Students develop skills in both traditional and digital drafting techniques, building design, sustainable practices, and professional documentation. Starting with fundamental drawing and design principles, students' progress to advanced Building Information Modeling (BIM) using industry-standard software like AutoCAD and Revit. The program emphasizes sustainable design practices and culminates in opportunities to earn both Autodesk Revit Certified User and LEED Green Associate certifications. Through hands-on projects, students learn to use professional tools and equipment including drafting tools, 3D printers, laser cutters, and environmental testing equipment while developing a professional portfolio.
 - D. Architectural Design I builds upon basic skills to develop proficiency in Building Information Modeling using Autodesk Revit. Students create detailed digital building models, produce construction documentation, and learn about building codes and cost estimation. The course includes advanced model-making using digital fabrication tools and prepares students for the Autodesk Revit Certified User exam. Students develop technical proficiency while learning to coordinate building systems and create professional documentation.
 - E. Students will participate in at least two Career-Connected Education and 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 through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.
3. **KNOWLEDGE AND SKILLS**
 - A. **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
 1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
 2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
 3. Employ effective reading, writing, and technical documentation skills.
 4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
 5. Demonstrate leadership skills and collaborate effectively as a team member.

6. Implement safety procedures, including proper handling of tools, equipment and hardware and following appropriate safety measures in the lab/shop environment.
7. Exhibit an understanding of legal and ethical responsibilities in the architectural field, following accessibility laws and best practices for design.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. The student identifies various career pathways in the Architectural Design and Drafting field.

The student is expected to:

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in architectural design.
2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in drafting and architectural design.

C. The student develops technology and digital literacy skills. The student is expected to:

1. Use technology as a tool for research, organization, communication, and problem-solving.
2. Use digital tools, including computers, mobile devices, collaboration platforms, and cloud services, to access, manage, and create information.
3. Demonstrate proficiency in using emerging and industry-standard technologies, including virtualization tools, design software, and related equipment. School systems, based on feedback from their business partners, could consider software such as TinkerCAD, AutoCAD, Revit, and Onshape, for scaffolded classroom implementation, and ultimately industry recognized certification.
4. Understand ethical and legal considerations for technology use, including the principles of data protection, copyright, and responsible technology use.

D. The student integrates core academic skills into architectural design practices. The student is expected to:

1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards.
2. Utilize intermediate mathematical concepts including trigonometric functions for roof and stair calculations, coordinate geometry for 3D modeling, statistical analysis for cost estimation, and complex geometric relationships in building component design.
3. Apply scientific principles including structural forces in building systems, material properties and strengths, fundamentals of building acoustics, and basic thermodynamic concepts in building envelope design.

E. The student demonstrates intermediate level understanding of Building Information Modeling concepts and techniques. The student is expected to:

1. Create building models, using architectural modeling software, that include fundamental residential/commercial components.
2. Construct multi-room floor plans by placing and modifying architectural elements (walls, doors, windows, and components) and applying constraints to control relationships between elements.
3. Apply advanced modification tools, including align, trim/extend, mirror, array, and split, to edit and refine building models.
4. Organize and manage multiple view types, including plans, sections, elevations, and callouts, within the project workspace.
5. Develop annotated drawings using dimensions, tags, symbols, and generate schedules to document elements such as doors and windows.

6. Edit and assign materials to model elements, and differentiate between model components and detail components.
7. Utilize and manage families or component libraries, including loading additional or custom content into a project.
8. Collaborate by linking external files or using built-in sharing tools to work as part of a team in architectural design software.
9. Compose comprehensive construction documentation sets using sheets, project metadata, title blocks, and sheet lists.
10. Implement view templates and control graphic display settings to present design intent professionally in printed or exported formats.
11. Export and share views or documentation in common digital file formats and print layouts as required for professional workflows.
12. Manage building information across various systems by creating custom families and scheduling building components accurately.
13. Calculate material quantities from BIM models by creating accurate material takeoffs and area calculations.
14. Estimate preliminary construction costs using current cost data and appropriate contingencies.

F. The student understands building codes and standards. The student is expected to:

1. Demonstrate knowledge of building codes and safety regulations, and why they exist.
2. Calculate basic occupant loads and egress requirements for different space types using appropriate code tables and formulas.
3. Apply relevant building codes to architectural designs including, but not limited to, required fire mitigation systems, egress paths, and accessibility requirements.
4. Evaluate designs for code compliance at an introductory level.

G. The student develops understanding of cost estimation. The student is expected to:

1. Calculate material quantities from BIM models by creating accurate material takeoffs and area calculations.
2. Estimate preliminary construction costs using current cost data and appropriate contingencies.
3. Compare different material and system options through cost-benefit analyses that consider initial and life-cycle costs.

****Systems that do not have software that can assist students with this task may consider digital tools, such as Procore, which include free online learning content.**

H. The student demonstrates intermediate level tool and equipment operation. The student is expected to:

1. Operate power and hand tools safely and effectively.
2. Create 3D models using rapid prototyping technologies.
3. Maintain tools and equipment through regular cleaning, calibration, and basic repairs.
4. Select appropriate tools and processes for specific modeling and prototyping tasks.

I. The student develops a professional portfolio. The student is expected to:

1. Organize digital and physical work products to demonstrate growing technical proficiency.
2. Write technical descriptions explaining modeling and documentation strategies used in projects.
3. Present portfolio work demonstrating intermediate levels of mastery of digital architectural design tools and architectural documentation.

Course Standards: Architectural Design II

1. **GENERAL REQUIREMENTS.** This course is recommended for students in Grades 10-12.

2. **INTRODUCTION**

- A. Career and Technical Education (CTE) 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.
- B. The Construction Career Cluster prepares students for careers in designing, planning, and building sustainable infrastructure. This field includes architects, engineers, construction managers, and skilled trades professionals.
- C. The Architecture Design and Drafting program prepares students for careers in architecture, engineering, and construction management through a comprehensive four-year sequence. Students develop skills in both traditional and digital drafting techniques, building design, sustainable practices, and professional documentation. Starting with fundamental drawing and design principles, students' progress to advanced Building Information Modeling (BIM) using industry-standard software like AutoCAD and Revit. The program emphasizes sustainable design practices and culminates in opportunities to earn both Autodesk Revit Certified User and LEED Green Associate certifications. Through hands-on projects, students learn to use professional tools and equipment including drafting tools, 3D printers, laser cutters, and environmental testing equipment while developing a professional portfolio.
- D. Architectural Design II focuses on environmentally responsive design strategies and integrated building systems. Students learn to use energy modeling software and environmental analysis tools to optimize building performance. The course includes study of mechanical, electrical, and plumbing systems while introducing LEED certification concepts. Students conduct site analyses, perform daylight studies, and develop sustainable design solutions through detailed technical documentation.
- E. Students will participate in at least two Career-Connected Education and 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 through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.

3. **KNOWLEDGE AND SKILLS**

- A. The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:**
 - 1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work.
 - 2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn.
 - 3. Employ effective reading, writing, and technical documentation skills.
 - 4. Solve problems using critical thinking techniques and structured troubleshooting methodologies.
 - 5. Demonstrate leadership skills and collaborate effectively as a team member.

6. Implement safety procedures, including proper handling of tools, equipment and hardware and following appropriate safety measures in the lab/shop environment.
7. Exhibit an understanding of legal and ethical responsibilities in the architectural field, following accessibility laws and best practices for design.
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting.

B. The student identifies various career pathways in the Architectural Design and Drafting field.

The student is expected to:

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in architectural design.
2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations.
3. Demonstrate effective interview skills for roles in drafting and architectural design.

C. The student develops technology and digital literacy skills. The student is expected to:

1. Use technology as a tool for research, organization, communication, and problem-solving.
2. Use digital tools, including computers, mobile devices, collaboration platforms, and cloud services, to access, manage, and create information.
3. Demonstrate proficiency in using emerging and industry-standard technologies, including virtualization tools, design software, and related equipment. School systems, based on feedback from their business partners, could consider software such as TinkerCAD, AutoCAD, Revit, and Onshape, for scaffolded classroom implementation, and ultimately industry recognized certification.
4. Understand ethical and legal considerations for technology use, including the principles of data protection, copyright, and responsible technology use.

D. The student integrates core academic skills into architectural design practices. The student is expected to:

1. Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards.
2. Apply advanced mathematical applications including energy performance calculations, statistical analysis of building systems, geometric optimization for solar design, and complex volumetric calculations for mechanical systems.
3. Demonstrate basic understanding of scientific principles including thermodynamics in building systems, fluid dynamics in HVAC design, solar geometry and physics, lighting physics, and environmental science concepts related to building performance.

E. The student comprehends advanced sustainable design principles. The student is expected to:

1. Evaluate building performance using energy modeling tools by conducting comparative analyses of different design options.
2. Design passive solar strategies by developing detailed wall sections and building orientations that maximize natural heating and cooling.
3. Integrate renewable energy systems into building designs through roof plans and equipment layouts that optimize system performance.
4. Create comprehensive energy conservation strategies by analyzing building envelope details and mechanical system efficiencies.

5. Calculate projected energy consumption through detailed energy models that consider occupancy patterns and climate data.

F. The student understands building systems integration. The student is expected to:

1. Understand impact of integrated mechanical systems including HVAC, water management, plumbing, electrical system layouts, etc.
2. Design and plan plumbing and water management systems that include site placement and environmental impact mitigation.
3. Create electrical and lighting plans that optimize energy efficiency while meeting illumination requirements.

G. The student demonstrates advanced proficiency in architectural design software. The student is expected to:

1. Design complex, multi-story building models utilizing advanced tools such as curtain walls, stairs, ramps, railings, and custom roof/floor systems to meet specific programmatic requirements.
2. Develop and manage project templates, view templates, and office standards that streamline workflow and ensure consistency across multiple design projects.
3. Construct and modify custom parametric families or components, including nested or adaptive elements, to expand modeling capabilities beyond preloaded libraries.
4. Integrate imported data from other software (e.g., CAD, GIS, point clouds) and utilize interoperability features to coordinate interdisciplinary project files.
5. Visualize design intent by producing advanced renderings, walkthroughs, phasing animations, and presentation boards using the architectural design software's built-in and supported rendering tools.
6. Optimize project workflow by applying worksharing principles, including creating and managing worksets and using central/local file systems in a team environment.
7. Justify design decisions, including leveraging exported plans, 3D views, data-rich visualizations, and supporting documentation to communicate solutions to technical and non-technical audiences.

H. The student shows an understanding of sustainable building and green design. The student is expected to:

1. Explain why buildings seek green certification and describe the main steps a project follows to get certified.
2. Describe what different team members do during the green building certification process and name the key stages along the way.
3. Describe what integrative design means and work with classmates on group activities that involve different perspectives in green building projects.
4. Discuss how choosing a location and ways to get around (like walking, biking, or taking the bus) can affect a building project.
5. Describe ways that site choices and designs can help the environment, such as capturing rainwater, reducing heat, lowering light pollution, and protecting green spaces.
6. Review strategies for using less water both inside and outside a building, including ways to measure water use and create water-saving landscapes.
7. Look at how buildings can use less energy, including using renewable energy sources, tracking energy use, and managing heating/cooling systems responsibly.
8. Compare different building materials and waste options and talk about how they help save resources and cut down on waste.
9. List and describe what makes a healthy indoor environment, like good air quality, safe materials, good lighting, quiet spaces, comfortable temperature, and natural daylight.

10. Read and understand a LEED scorecard, including the main requirements, credit points, and types of green building rating systems.
11. Use basic green building math (like figuring out water or energy saved) for sample projects and activities.

I. The student develops a professional portfolio with sustainability focus. The student is expected to:

1. Document sustainable design strategies through detailed analysis drawings and written narratives.
2. Create infographics that clearly communicate building performance data and environmental strategies.
3. Organize and present energy modeling results and system optimization studies.
4. Write case studies of sustainable design projects including metrics and performance data. The student is expected to:
5. Conduct comprehensive site analyses using digital tools to document solar exposure, wind patterns, and other environmental factors.
6. Perform daylight analysis studies using physical models and computer simulations to optimize window placement and shading devices.
7. Evaluate building envelope performance through detailed wall section analysis and thermal modeling.
8. Create water management strategies by developing site plans that incorporate bioswales, retention ponds, and permeable surfaces.