

CONSTRUCTION

Standards and Benchmarks

Safety

Standard I: Understand the basic safety and safety operating procedures necessary for a construction project.

Benchmarks

1. Comply with shop and equipment safety rules.
2. Inspect workplaces for safe working environment and report unsafe conditions.
3. Correct safety hazards.
4. Clean and maintain work area and leave in safe condition.
5. Follow tool checkout and maintenance procedures including reporting of equipment failures.
6. Demonstrate proper shoveling and lifting techniques.
7. Explain the application of first aid interventions for particular situations.
8. Explain OSHA job safety compliance.
9. Implement and comply with OSHA job site safety rules.

Standard II: Understand the basic background knowledge required for entry into the construction industry.

Benchmarks

1. Cut material to specified dimensions and shape.
2. Install and remove fasteners properly (i.e., nails, screws, and anchor bolts).
3. Measure and compute using fractions and decimals.
4. Measure accurately and use the following instruments; ruler, tape measure, chalk line, level, transit, and square.
5. Explain the importance of estimating to the construction trade.
6. Identify the parts of a structure from a cross-section on a blueprint.
7. Identify basic materials for a particular trade or process.
8. Identify anchors, hangers and supports and their appropriate use of each trade.

Preplanning

Standard III: Understand the basic sequence of procedures necessary for a construction project.

Benchmarks

1. Receive, inspect, inventory, stack, and properly store equipment, materials, and supplies on-site.
2. Interpret a materials list.
3. Explain the cost of doing a job to include labor, tools, materials and overhead and their relationship to profit.
4. Compute the quantity of commonly used materials needed for a job (i.e., area, cubic area, and linear measurement).
5. Identify parts and materials using a suppliers' and manufacturers' catalog/manual.

Sitework

Standard IV: Understand the processes and activities that must be completed to prepare a site for construction.

Benchmarks

1. Explain how to prepare a building site to include the following: establish elevation reference points from bench mark; establish footing grades; locate and square corners; install batter boards; set grade stakes; and lay out building using transit.

Construction Processes

Standard V: Differentiate among and apply the appropriate methods and processes to various construction materials and their installation.

Concrete

Benchmarks

1. Explain all components of preparing foundations and footings.
2. Build forms for concrete including the erection of wall forms to include anchor bolts, bulkheads and key-way on an appropriate footing.
3. Pour, screed and finish concrete.
4. Strip and clean forms.
5. Demonstrate appropriate handling and placing techniques.

Masonry

Benchmarks

1. Explain bonding of masonry walls.
2. Explain joint finishes.
3. Demonstrate appropriate mortar mixing techniques.
4. Demonstrate appropriate layout techniques for inside and outside corners.

Metals

Benchmarks

1. Measure, cut, form, fit, and install metal flashing.
2. Measure, cut and install metal siding.
3. Measure, fit and install metal trim.

Woods and Plastics

Benchmarks

1. Identify parts of a stair and compute rise, run, and headroom.
2. Rough in wall, roof, and floor systems.
3. Install cabinetry and case work.
4. Miter and install molding trim.
5. Install prefab truss or rafter roof system.
6. Lay out structural members on center.

Thermal and Moisture Protection

Benchmarks

1. Identify the side wall and ceiling insulation, vapor barriers, ventilation and air infiltration.
2. Identify types of roofing systems including common standards associated with roofing (i.e., flashing, penetrations, and installation).

3. Install insulation.
4. Observe appropriate waterproofing and drainage procedures.

Door and Windows

Benchmarks

1. Install prehung door and/or precased window.

Finishes

Benchmarks

1. Identify different types of exterior finishes (i.e., cornice, door, window, siding, fascia, and soffit).
2. Identify the pros and cons of exterior finishes (i.e., stucco, wood, masonry, aluminum, and vinyl).
3. Identify different types of interior finishes for molding trims, cabinets, doors, hardware, walls, etc.
4. Explain the proper procedures for preparing a surface for finishing and selecting a proper finish (i.e., wood, metal, and masonry).
5. Demonstrate appropriate techniques for installing and finishing drywall.
6. Identify various floor-covering options.

Equipment

Standard VI: Use the appropriate equipment for the particular situation.

Benchmarks

1. Inspect climbing equipment and demonstrate the setup of ladders, ladder jacks, planks, and scaffolds.
2. Maintain and utilize basic hand and power tools from one of the following: hacksaw, circular saw, handsaw, screwdrivers, drills and bits, carpentry, masonry, electrical, HVAC, plumbing.
3. Explain the use of earth moving site preparation equipment in preparing construction sites.
4. Explain proper safety procedures for a safe working environment regarding on site construction vehicles (forklifts, bulldozers, track loader backhoes, dump trucks, etc).
5. Explain proper safety considerations for work in or near open excavations.

Electrical

Standard VII: Apply basic electrical techniques.

Benchmarks

1. Splice a wire correctly.
2. Wire and diagram the following switching arrangements: a. 3-way switching system on one light; b. a single pole switch on one light; c. a single pole switch on two lights; and d. a duplex receptacle.
3. Identify and explain ground fault protection, and where they are required.
4. Identify types and sizes of wire, wire coverings and appropriate short circuit protections.
5. Identify types and sizes of electrical conduits and demonstrate connection techniques.
6. Identify the method of transporting electrical power from generating station to utilization locations.

7. Diagnose malfunctions of simple electrical systems using test and measurement equipment and repair; such as voltmeter, amp meter and ohmeter.
8. Read and explain information given on motor nameplates.
9. Observe the installation and connection of an electrical service entrance and breaker box.

Mechanical

Standard VIII: Understand the basic mechanical procedures involved in the construction industry.

Benchmarks

1. Explain the difference between the components and operation of the following HVAC systems: steam, hot water, forced air and unit ventilation, air conditioning, and solar systems.

54

Plumbing

Standard IX: Understand the basic plumbing procedures involved in the construction industry.

Benchmarks

1. Explain the installation of water faucet and water closet replacement.
2. Identify the plumbing system in a structure (i.e., ventilation, sewage, potable water, etc.).
3. Identify the components and functions of sanitary and storm sewer systems in a community.

Digital Electronics

Standards

Students will be able to:

1. Use a digital electronics software package to design, build and trouble shoot any digital projects.
2. Understanding science rules of electronics, Ohm's Law, Kirchhoff's Law Boolean algebra, DE Morgan's Theorems, and K-mapping.
3. Develop presentations on major concepts and components used in digital electronics.
4. Work in teams to design and build digital electronics projects.

Benchmarks

Students will be able to:

1. Identify the attributes, uses, advantages, and disadvantages of the components used in electronics by using the suitcase trainer and using Multisim software.
2. Develop power point presentation on major concepts and components used in digital electronics.
3. Work effectively in an engineering team to design and trouble shooting digital electronics projects.
4. Design and implement solutions to problems encountered in electronics by uses of laws of Boolean algebra.
5. Identify the attributes, uses, advantages, and disadvantages of shift registers, asynchronous counters and synchronous counters.
6. Write programs to control electronics by the use of Basic Stamp and Boolean algebra, to control servo robots, and automated control systems.
7. Utilize state machines to enhance lessons on flip-flop circuits by programming a chip.
8. Understand all background information necessary to use ohm's law and kirchoff's laws of electricity.
9. Understand basic fluid power systems.
10. Identify the attributes, uses, advantages, and disadvantages of seven segment displays, multiplexers and demultiplexers.

Introduction to Engineering Design (IED)

Standards

Students will be able to:

1. Demonstrate the ability to use three-dimensional modeling software.
2. Demonstrate the use of problem-solving model to improve existing products and invent new ones in and outside the classroom.
3. Experience the creative thinking process through the use of vertical and lateral thinking; identifying, categorizing, and selecting a solution to a problem; and communicate the solution in written and verbal formats.

Benchmarks

Students will be able to:

1. Discuss the history of engineering and engineering technology design.
2. Utilize sketching and visualization techniques.
3. Communicate conceptual ideas through written and verbal formats.
4. Practice effective oral communication techniques.
5. Apply the steps of the design process to solve a variety of design problems.
6. Translate a three-dimensional drawing or model into corresponding.

Principles of Engineering

Standards

Students will be able to:

1. Understand and apply math and science concepts.

Benchmarks

Students will be able to:

1. Determine efficiency; calculate work; and mechanical advantages of mechanical systems.
2. Calculate circuit resistance, current, and voltage using Ohm's Law.
3. Complete calculations for conduction, R-values, and radiation.
4. Compute center of gravity, moment of inertia, stress, strain, deflection, mean, median, mode, and standard deviation.
5. Calculate weight, volume, mass, density, and surface area of selected products.
6. Perform nondestructive and descriptive testing on materials.
7. Design a control system based on given needs and constraints.
8. Calculate values in a pneumatic system, and calculate flow rate, flow velocity and mechanical advantage in a hydraulic system.
9. Calculate distance, displacement, speed, velocity, and acceleration from data.
10. Communicate in team settings using effective presentation skills.

CAD 1

Standards

Students will be able to:

1. Provide the basic information necessary for planning various types of working drawings.
2. Develop the necessary technical skills to communicate engineering concepts in an understandable, efficient and accurate manner.
3. Utilize the latest drawing techniques to incorporate communication and engineering career opportunities.

Benchmarks

Students will be able to:

1. Exhibit knowledge of drafting standards.
2. Understand the need for sketching skills.
3. Produce a working drawing.
4. Demonstrate skills in developing orthographic projection.
5. Use proper dimensioning rules.
6. Produce a detailed section drawing.
7. Produce a detailed auxiliary drawing.
8. Produce three different pictorial drawings.
9. Exposure to drafting career paths.
10. Demonstrate knowledge of CAD systems used in the preparation of drawings used in engineering.

CAD 2

Standards

Students will be able to:

1. Provide the advanced information necessary for planning various types of working drawings.
2. Develop the advanced technical skills to communicate engineering concepts in an understandable, efficient and accurate manner.
3. Utilize the latest drawing techniques to incorporate communication and engineering career opportunities.

Benchmarks

Students will be able to:

1. Exhibit an advanced knowledge of drafting standards.
2. Understand the need for sketching skills.
3. Produce an advanced working drawing.
4. Demonstrate higher skills in developing orthographic projection.
5. Use proper dimensioning rules.
6. Produce an advanced detailed section drawing.
7. Produce an advanced detailed auxiliary drawing.
8. Produce an advanced three different pictorial drawings.
9. Exposure to drafting career paths.
10. Demonstrate advanced knowledge of CAD systems used in the preparation of drawings used in engineering.

CAD 3

Standards

Students will be able to:

1. To provide the basic information necessary for planning various types of structures.
2. Develop the necessary technical skills to communicate architectural concepts in an understandable, efficient and accurate manner.
3. Utilize the latest products and building techniques to incorporate communication and architectural career opportunities.

Benchmarks

Students will be able to:

1. Exhibit knowledge of drafting standards.
2. Design a set of plans using sketching and drafting tools.
3. Know the required drawings needed to make a set of construction plans.
4. Develop a set of construction plans.
5. Demonstrate proper dimensioning rules used on architectural plans.
6. Draw section drawings for a set of plans.
7. Demonstrate the knowledge of a CAD system.
8. Operate a CAD program to produce a set of plans.
9. Demonstrate presentation methods.
10. Investigate

CAD 4

Standards

1. Demonstrate comprehension, computation, and applied technology skills for 3d drawing.
2. Develop communication, employability and life management skills.

Benchmarks

1. Demonstrate the proper use of CAD software.
2. Complete orthographic, isometric and sectional drawings using CAD software.
3. Determine proper drawing set-up procedures.
4. Use proper terminology as it relates to drafting.
5. Demonstrate the use of math as it relates to CAD.
6. Output a drawing using a printer.
7. Benchmarks: Demonstrate good preparation and organizational skills for class.
8. Demonstrate an understanding of the educational qualifications and levels of Computer Aided Drafting.
9. Demonstrate punctuality, responsibility, reliability, and honesty.
10. Demonstrate self-regulation.
11. Demonstrate problem solving skills.

CAD 5

Standards

1. Demonstrate comprehension, computation, and applied technology skills for 3d animation software.
2. Develop communication, employability and life management skills.

Benchmarks

1. Demonstrate the proper use of 3d animation software.
2. Complete orthographic, isometric and sectional drawings using 3d animation software.
3. Determine proper drawing set-up procedures.
4. Use proper terminology as it relates to animation design.
5. Demonstrate the use of math as it relates to 3d animation.
6. Output 3d animation drawings using a printer.
7. Demonstrate good preparation and organizational skills for class.
8. Demonstrate an understanding of the educational qualifications and levels of 3d animation.
9. Demonstrate punctuality, responsibility, reliability, and honesty.
10. Demonstrate self-regulation.
11. Demonstrate problem solving skills.

CAD 6

Standards

1. Demonstrate comprehension, computation, and applied technology skills for program that will be use by this student in their career.
2. Develop communication, employability and life management skills.

Benchmarks

1. Demonstrate the proper use of CADsoftware.
2. Complete orthographic, isometric and sectional drawings using CAD software.
3. Determine proper drawing set-up procedures.
4. Use proper terminology as it relates to CAD design.
5. Demonstrate the use of math as it relates to CAD industry.
6. Output drawings using a printer.
7. Demonstrate good preparation and organizational skills for class.
8. Demonstrate an understanding of the educational qualifications and levels CAD industry.
9. Demonstrate punctuality, responsibility, reliability, and honesty.
10. Demonstrate self-regulation.
11. Demonstrate problem solving skills.

MANUFACTURING

Standards

Students will be able to:

1. Understand and apply the fundamentals of manufacturing.
2. Understand and apply manufacturing processes.
3. Understand and demonstrate production techniques.
4. Understand and demonstrate the use of materials in manufacturing.

Benchmarks

Students will be able to:

1. Apply basic emergency first aid techniques.
2. Comply with school district rules.
3. Inspect, clean and organize work area and equipment for appropriate equipment use.
4. Identify various manufacturing enterprises.
5. Identify and maintain handtools for a specified job.
6. Measure parts with metric and English systems.
7. Discuss mechanical advantage applications.
8. Set up and use power saws.
9. Recognize when cutting tools need reconditioning or service. Clean and store precision measurement tools, handtools, cutters, jigs, fixtures, and grinding wheels.
10. Demonstrate proper care and storage of lab tools.
11. Perform maintenance procedures on lab equipment.
12. Explain career pathways in manufacturing occupations.
13. Explain industrial relations in manufacturing.
14. Explain various classes/types of finishes.
15. Cut threads with various processes.
16. Process materials with portable power tools.
17. Measure parts using precision measurement tools (i.e., micrometer, vernier, dialcalipers, and dial indicators).
18. Measure, calculate and layout precision patterns.
19. Apply jigs and fixtures for machine operations.
20. Set up and use precision machining equipment.
21. Explain destructive and nondestructive methods of testing.
22. Identify and explain hydraulic systems.
23. Identify and explain pneumatic systems.
24. Identify and explain electrical systems.
25. Identify valves and control systems.
26. Interpret and use prints, charts, diagrams, tables, and graphs.
27. Draw sketch of desired work piece (manual or CAD).
28. Develop bill of materials.
29. Plan operation flowchart for production.
30. Explain CAD/CAM/CNC and robotics and describe its use in flexible manufacturing system(CIM).
31. Utilize advanced math skills in product design and development.
32. Demonstrate material fabrication.