Computer Integrated Manufacturing - AES

Level: 3
Career Cluster: Advanced Manufacturing
Program: Engineering
Pathway(s): Aerospace Engineering Technician

Course Catalog Description

Computer Integrated Manufacturing introduces students to modern manufacturing systems used to design, produce, and evaluate aerospace parts and assemblies. Students use CAD/CAM, robotics, automation, and production technologies to create manufacturing solutions that reflect aerospace industry expectations for precision, safety, quality, and documentation.

Summary

Engineering course that prepares students to understand, design, and improve manufacturing systems used in aerospace production through the integration of engineering design, automation, robotics, and precision fabrication technologies. Building on foundational concepts in manufacturing and aerospace engineering technician pathways, students explore career opportunities, professionalism, ethics, and postsecondary options while developing technical skills that reflect real-world aerospace and advanced manufacturing industry expectations. Throughout the course, students apply the engineering design process to solve manufacturing challenges related to aerospace components and assemblies, create and revise digital models and technical drawings using CAD software, and use CAM tools to prepare designs for production. Students gain hands-on experience with additive manufacturing, CNC operations, robotics, and control systems while learning safe laboratory practices, proper equipment use, and responsible decision-making in manufacturing environments where reliability and precision are critical. In addition, students analyze aerospace-relevant materials, production methods, tolerances, cost factors, quality control measures, and process efficiency in order to make informed engineering and manufacturing decisions. By the end of the course, students will be able to document, present, and defend technical solutions and complete an integrated manufacturing project that demonstrates their ability to design, produce, test, evaluate, and improve a full aerospace-oriented manufacturing process.

Notes

This updated course expands the older course by shifting to a more clearly organized, standards-based structure with defined objectives, measurable student outcomes, and embedded academic alignment. While the previous version emphasized engineering design, ethics, CAD/CAM, CNC, robotics, and manufacturing systems, this new version strengthens the course through a stronger aerospace focus, clearer progression across additive and subtractive manufacturing, control systems, quality improvement, cost analysis, technical documentation, and a culminating integrated manufacturing project. It also adds dedicated outcomes for leadership and work-based learning to better reflect current Colorado CTE expectations and career-connected instruction.

Student Learning Outcomes

1. Career Exploration and Postsecondary Opportunities

Objective: *Students will analyze career pathways in aerospace engineering technician by exploring industry roles, workplace expectations, required education, certifications, professional organizations, and postsecondary opportunities available in Colorado in order to make informed academic and career decisions.*

1) Identify employment opportunities in various fields with a focus in the area of aerospace engineering technician
    a. Recognize the work typically performed, tools and technology used, and nature of work environments
    b. Identify potential certifications within the careers
    c. Find membership organizations associated with the careers
    d. Understand the necessary education associated within the careers
2) Define professionalism within the context of aerospace engineering technician
    a. Criticism and evaluation
    b. Presentation
    c. Assessment
3) Recognize laws, regulations, and ethics significant to the fields of aerospace engineering technician
4) Identify postsecondary opportunities offered in the state of Colorado
    a. Technical college, community college, 4-year institutions
    b. Certificates, associates, bachelor, and advanced degree opportunities

2. Foundations of Integrated Manufacturing Systems

Objective: *Students will analyze the structure and purpose of integrated manufacturing systems in order to explain how design, automation, and production processes work together in aerospace manufacturing environments.*

5) Define computer integrated manufacturing and its role in modern engineering
6) Identify the major components of an integrated manufacturing system
7) Describe the relationship among product design, automation, robotics, and aerospace manufacturing
8) Analyze how integrated systems improve productivity, consistency, and efficiency
9) Compare manual, automated, and computer-integrated production processes used in aerospace manufacturing
10) Evaluate the impact of system integration on manufacturing performance

3. Safety and Manufacturing Laboratory Practices

Objective: *Students will apply safe operating procedures and responsible lab practices to minimize risk in manufacturing and automation environments.*

11) Interpret manufacturing lab safety procedures and equipment guidelines
12) Demonstrate safe use of fabrication tools, machines, and digital equipment

13) Identify hazards associated with rotating machinery, cutting tools, robotics, and fabrication materials
14) Apply personal protective equipment and safe workstation procedures
15) Inspect tools and work areas for safe operation
16) Evaluate manufacturing tasks for compliance with safety expectations

4. Engineering Design Process and Product Development

Objective: *Students will apply the engineering design process to develop and refine aerospace manufacturing solutions that meet defined criteria and constraints.*

17) Define the steps of the engineering design process
18) Interpret design criteria and constraints for a manufacturing challenge
19) Generate multiple design concepts for a product or system
20) Develop a design plan based on function, manufacturability, and user needs
21) Analyze prototype feedback to improve design solutions
22) Evaluate final design decisions based on performance and production readiness

5. Technical Drawing CAD and Digital Modeling

Objective: *Students will create digital design models and technical documentation to communicate aerospace part and assembly specifications accurately.*

23) Identify the purpose of CAD in product development and manufacturing
24) Create 2D sketches and 3D models using industry-relevant software
25) Apply dimensions, constraints, and geometric relationships in digital models
26) Interpret technical drawings and model views
27) Modify digital models to meet updated requirements
28) Evaluate digital designs for precision, usability, and manufacturability

6. CAM Systems and Manufacturing Toolpaths

Objective: *Students will apply CAM concepts to prepare designs for automated manufacturing processes.*

29) Define the role of CAM in computer integrated manufacturing
30) Convert digital designs into manufacturing-ready formats
31) Identify toolpaths, machining operations, and setup requirements
32) Analyze how design decisions affect machining strategy
33) Prepare files for additive or subtractive production
34) Evaluate CAM outputs for efficiency, precision, and readiness

7. Additive Manufacturing and Rapid Prototyping

Objective: *Students will use additive manufacturing processes to prototype and evaluate product designs.*

35) Describe the purpose and workflow of additive manufacturing
36) Prepare digital models for 3D printing or related prototyping methods
37) Produce prototype parts using additive processes

38) Analyze how print orientation, material choice, and settings affect outcomes
39) Inspect prototypes for dimensional accuracy and usability
40) Evaluate prototype quality and recommend design revisions

8. Subtractive Manufacturing and CNC Operations

Objective: *Students will operate and evaluate subtractive manufacturing systems to produce parts that meet design specifications.*

41) Describe the role of subtractive manufacturing in production systems
42) Identify the basic functions of CNC mills and related equipment
43) Interpret machining setup requirements and operational steps
44) Operate CNC equipment using approved procedures
45) Measure completed parts against design criteria
46) Evaluate machining results for accuracy, finish, and production quality

9. Robotics and Automated Production Systems

Objective: *Students will analyze and apply robotic systems in order to support automated manufacturing tasks.*

47) Identify components of robotic and automated production systems
48) Explain how robotics supports manufacturing efficiency and consistency
49) Operate robotic systems using approved procedures or controls
50) Analyze the sequence of robotic actions in a production task
51) Integrate robotic tools into a larger manufacturing process
52) Evaluate robotic system performance based on task completion and system efficiency

10. Control Systems and System Integration

Objective: *Students will integrate control systems and manufacturing technologies to coordinate automated production processes.*

53) Define control systems and their role in manufacturing automation
54) Identify inputs, outputs, and process controls in a manufacturing system
55) Explain how multiple subsystems work together in integrated production
56) Construct or simulate a simple system integration workflow
57) Analyze how system interruptions affect production performance
58) Evaluate integrated systems for reliability and efficiency

11. Materials Processes and Production Decision Making

Objective: *Students will analyze materials and manufacturing processes in order to select appropriate production methods for aerospace engineering applications.*

59) Identify common materials used in manufacturing and prototyping
60) Compare materials based on strength, cost, finish, and process compatibility
61) Explain how material choice influences manufacturing decisions
62) Select processes appropriate to material and product requirements
63) Analyze tradeoffs among durability, cost, and production efficiency

64) Evaluate production decisions using evidence from testing or process data

12. Quality Control Inspection and Process Improvement

Objective: *Students will apply quality control methods to inspect and improve aerospace manufacturing products and processes.*

65) Define quality standards in manufacturing and production settings
66) Measure finished products using appropriate inspection tools
67) Identify defects, inconsistencies, and process errors
68) Analyze root causes of quality issues in design or production
69) Recommend process improvements to increase consistency and precision
70) Evaluate production outcomes against product requirements and quality expectations

13. Cost Efficiency and Manufacturing Optimization

Objective: *Students will analyze manufacturing efficiency and resource use in order to optimize product production.*

71) Identify cost factors in manufacturing systems including material, time, and machine use
72) Calculate basic production estimates using available data
73) Analyze how workflow decisions affect time and efficiency
74) Compare alternative production strategies for a given task
75) Recommend changes that reduce waste and improve throughput
76) Evaluate the effectiveness of an optimized manufacturing process

14. Technical Documentation and Manufacturing Communication

Objective: *Students will document and communicate technical information clearly in order to support manufacturing design and production work.*

77) Create technical documentation for parts, processes, and production tasks
78) Organize manufacturing notes, design files, and process records
79) Use technical vocabulary accurately in written and verbal formats
80) Present design and production decisions using evidence and visuals
81) Defend a manufacturing solution using data and engineering reasoning
82) Evaluate documentation for clarity, completeness, and technical accuracy

15. Integrated Manufacturing Project

Objective: *Students will design, produce, test, and present a complete aerospace manufacturing solution that demonstrates mastery of integrated systems concepts.*

83) Define a manufacturing challenge or production objective
84) Design a product and production plan using CAD/CAM tools
85) Construct or fabricate components using appropriate manufacturing methods
86) Integrate automation, tooling, or robotic processes into production
87) Test the product and process for function, accuracy, and efficiency
88) Revise the design or workflow based on testing and feedback
89) Present the final product, process, and rationale to an audience

90) Reflect on engineering decisions, system performance, and learning growth

16. Leadership

Objective: *Students will develop and demonstrate leadership skills by applying responsibility, collaboration, ethical decision-making, and effective communication in classroom, project, and career-connected settings.*

91) Demonstrate responsibility, accountability, and initiative in individual and team-based manufacturing tasks
92) Apply effective verbal, written, and interpersonal communication during projects and presentations
93) Collaborate with peers to set goals, solve problems, and contribute to shared project outcomes
94) Demonstrate ethical decision-making and professional behavior in classroom and career-connected settings
95) Evaluate personal leadership strengths and areas for growth through reflection and feedback

17. Work-Based Learning

Objective: *Students will connect classroom learning to workplace expectations by participating in career-connected experiences, applying technical and employability skills, and reflecting on professional growth in authentic work-based learning environments.*

96) Identify the purpose and value of work-based learning experiences in manufacturing and engineering pathways
97) Apply technical and employability skills during workplace simulations, job shadows, internships, or industry-connected projects
98) Demonstrate workplace expectations such as punctuality, communication, teamwork, and professionalism
99) Analyze how classroom knowledge and technical skills transfer to authentic workplace tasks and responsibilities
100) Reflect on work-based learning experiences to assess career interests, readiness, and professional growth

18. Career and Technical Student Organizations

Objective: *Using the CTSO Resource Document, chapter activities will provide some of the best opportunities CTSO members will have to learn by doing. A successful program of work creates a positive learning atmosphere in the classroom. CTSO members learn how to accept responsibility, work as a team, manage a budget, and handle success and failure. Per the CTE Admin Handbook, CTSOs are embedded into curriculum.*

Professional Development

Prepare each member for entry into the workforce and provide a foundation for success in a career. Becoming a professional does not stop with acquiring a skill, but involves an increased awareness of the meaning of good citizenship and the importance of labor and management in the world of work.

Community Service

Promote and improve goodwill and understanding among all segments of the community through services donated by CTSO chapters, and to instill in its members a lifetime commitment to community service.

Business and Industry Connections

Increase awareness of quality job practices and attitudes, and increase the opportunities for employer engagement and eventual employment.

Financial Leadership

Plan and participate in activities to allow all members to carry out the chapter's projects. Educate members on their own personal finance for current and future success.

Public Relations

Make the general public aware of the good work that students in career and technical education are doing to better themselves and their community, state, nation, and world.

Social Activities

To increase cooperation in the school and community through activities that allow CTSO members to get to know each other in something other than a business or classroom setting.

Academic Standards Alignment

Colorado CTE courses are required to integrate academic and essential skills into course content. The following academic standards have been identified as aligned to this course and should be integrated throughout instruction.

CO CTE Academic Standards Resources (Rubrics, integration strategies, etc)
CDE Colorado Academic Standards Online (Online standards lookup tool)

Note: Mathematics and Science standards will be added in the future. Visit the Colorado Academic Standards page for the most current version.

Reading, Writing and Communicating Crosswalk

Course: Computer Integrated Manufacturing
Colorado Academic Standards – Reading, Writing, and Communicating

Standard	Prepared Graduate Competency	Description	Course Evidence / Alignment
Standard 1: Oral Expression and Listening	Prepared Graduate 1 – Collaboration	Collaborate effectively as group members or leaders.	Students work in teams to design and execute integrated manufacturing systems, collaborate during automation, robotics, CNC, and production workflows, and listen to feedback while contributing ideas to shared aerospace engineering and manufacturing objectives.
Standard 1: Oral Expression and Listening	Prepared Graduate 2 – Oral Presentations	Deliver effective oral presentations for varied audiences and purposes.	Students present aerospace manufacturing solutions and automated system designs, explain production processes, precision and safety considerations, and communicate technical decisions

			to peers, instructors, and stakeholders.
Standard 2: Reading for All Purposes	Prepared Graduate 4 – Informational Texts	Read a wide range of informational texts to build knowledge.	Students read and interpret technical manuals, CAD/CAM documentation, CNC specifications, aerospace quality standards, safety guidelines, system documentation, and informational texts related to aerospace manufacturing systems and automation.
Standard 2: Reading for All Purposes	Prepared Graduate 5 – Language in Context	Understand how language functions in different contexts.	The course requires students to use precise engineering and manufacturing terminology, interpret symbolic, numeric, and procedural technical language, and adapt language for design reviews, documentation, and presentations.
Standard 3: Writing and Composition	Prepared Graduate 6 – Craft arguments	Craft arguments using techniques specific to the genre.	Students defend design and manufacturing decisions, justify material choices, system configurations, and process efficiencies, and support claims using data, constraints, and engineering analysis.
Standard 3: Writing and Composition	Prepared Graduate 7 – Informational Writing	Craft informational/explanatory	Students produce technical reports and process

		texts using techniques specific to the genre.	documentation, explanatory writing describing automated systems and workflows, and written analyses of aerospace materials, tolerances, costs, and production outcomes.
Standard 3: Writing and Composition	Prepared Graduate 9 – Writing Process	Demonstrate mastery of their own writing process.	Students draft, revise, and finalize professional technical documentation, produce clear and accurate written products, and meet industry standards for clarity and correctness in manufacturing documentation.
Standard 4: Research Inquiry and Design	Prepared Graduate 10 – Research and Ethics	Gather information from a variety of sources; analyze and evaluate its quality and relevance.	Students research manufacturing methods, materials, and automation strategies, analyze cost, efficiency, and system performance data, and use information ethically to inform engineering and production decisions.

Free Resource Links

1. Career Exploration and Postsecondary Opportunities

- O NET Online (careers advanced manufacturing engineering technician pathways) https://www.onetonline.org/
- My Next Move (career exploration engineering manufacturing pathways) https://www.mynextmove.org/
- CareerOneStop (training certifications manufacturing workforce careers) https://www.careeronestop.org/
- CCCS Career Advising (Colorado postsecondary pathways engineering manufacturing) https://cccs.edu/career-advising/

2. Foundations of Integrated Manufacturing Systems

- MIT OpenCourseWare Manufacturing (manufacturing systems automation concepts) https://ocw.mit.edu/
- SME Education Foundation (manufacturing systems industry concepts resources) https://www.smeef.org/
- National Institute of Standards and Technology (manufacturing systems standards integration) https://www.nist.gov/
- Engineering Explained (systems engineering manufacturing integration concepts) https://www.engineeringexplained.com/

3. Safety and Manufacturing Laboratory Practices

- OSHA (manufacturing safety workplace hazards compliance standards) https://www.osha.gov/
- CDC NIOSH (industrial safety hazard prevention manufacturing labs) https://www.cdc.gov/niosh/
- Tool Box Talks (manufacturing shop safety procedures training) https://www.toolbox-talks.com/
- Manufacturing Institute Safety (industry safety manufacturing practices) https://www.themanufacturinginstitute.org/

4. Engineering Design Process and Product Development

- NASA Engineering Design Process (engineering design steps iterative problem solving) https://www.nasa.gov/stem
- Teach Engineering Design (product design engineering process lessons) https://www.teachengineering.org/
- IDEO Design Thinking (design thinking innovation product development) https://designthinking.ideo.com/
- MIT OpenCourseWare Design (engineering design product development systems) https://ocw.mit.edu/

5. Technical Drawing CAD and Digital Modeling

- Autodesk Design Academy (CAD modeling technical design tools) https://academy.autodesk.com/

- SolidWorks Tutorials (3D modeling engineering design CAD applications) https://www.solidworks.com/
- Fusion 360 Learning (CAD modeling product design engineering tools) https://www.autodesk.com/education
- SketchUp Campus (3D modeling digital design visualization tools) https://learn.sketchup.com/

6. CAM Systems and Manufacturing Toolpaths

- Autodesk CAM Resources (cam toolpaths manufacturing machining design) https://cam.autodesk.com/
- Fusion 360 CAM Tutorials (cam toolpath programming machining workflows) https://www.autodesk.com/education
- CNC Concepts (cam machining toolpath planning basics) https://www.cnccookbook.com/
- MIT Manufacturing Course (cam systems manufacturing automation processes) https://ocw.mit.edu/

7. Additive Manufacturing and Rapid Prototyping

- Ultimaker Learning (3D printing additive manufacturing basics) https://ultimaker.com/learn/
- MatterHackers Resources (additive manufacturing prototyping materials processes) https://www.matterhackers.com/
- 3D Printing Industry (additive manufacturing trends applications) https://3dprintingindustry.com/
- Tinkercad Design (3D printing prototyping modeling tools) https://www.tinkercad.com/

8. Subtractive Manufacturing and CNC Operations

- Haas CNC Learning (cnc machining operations fundamentals tools) https://www.haascnc.com/
- CNC Cookbook (cnc machining programming operations basics) https://www.cnccookbook.com/
- MIT OpenCourseWare Machining (subtractive manufacturing cnc processes) https://ocw.mit.edu/
- Tooling U SMT (cnc machining workforce training manufacturing skills) https://www.toolingu.com/

9. Robotics and Automated Production Systems

- FIRST Robotics Resources (robotics automation manufacturing systems design) https://www.firstinspires.org/
- Carnegie Mellon Robotics Academy (robotics systems automation education resources) https://www.cmu.edu/roboticsacademy/
- ABB Robotics Education (industrial robotics automation systems manufacturing) https://new.abb.com/products/robotics

- FANUC Education (industrial robots automation training systems) https://www.fanucamerica.com/

10. Control Systems and System Integration

- MIT OpenCourseWare Control Systems (control systems integration engineering fundamentals) https://ocw.mit.edu/
- National Instruments LabVIEW (control systems data acquisition integration tools) https://www.ni.com/
- Siemens Automation (control systems industrial automation integration) https://www.siemens.com/
- PLC Basics (programmable logic controller systems automation control) https://www.plcacademy.com/

11. Materials Processes and Production Decision Making

- MatWeb Materials Database (engineering materials properties selection) https://www.matweb.com/
- ASM International (materials science engineering processes manufacturing) https://www.asminternational.org/
- Engineering Toolbox Materials (materials properties manufacturing selection) https://www.engineeringtoolbox.com/
- Materials Science Khan Academy (materials properties structure engineering basics) https://www.khanacademy.org/science

12. Quality Control Inspection and Process Improvement

- ASQ Quality Resources (quality control inspection process improvement) https://asq.org/
- NIST Quality Standards (quality standards manufacturing inspection systems) https://www.nist.gov/
- Lean Six Sigma Resources (process improvement efficiency quality tools) https://www.leansixsigma.com/
- ISO Standards (quality management systems manufacturing standards) https://www.iso.org/

13. Cost Efficiency and Manufacturing Optimization

- Investopedia Cost Analysis (cost analysis production efficiency basics) https://www.investopedia.com/
- Lean Manufacturing Institute (lean manufacturing waste reduction efficiency) https://www.lean.org/
- SME Manufacturing Resources (manufacturing cost efficiency optimization practices) https://www.sme.org/
- Engineering Toolbox Cost (engineering cost estimation production systems) https://www.engineeringtoolbox.com/

15. Integrated Manufacturing Project

- SME Education Foundation PRIME (manufacturing engineering projects school industry partnerships)
  https://www.smeef.org/prime-schools-initiative/sme-prime/
- IACMI Workforce Programs (advanced manufacturing workforce projects CNC composites careers)
  https://www.iacmi.org/workforce/programs/
- National Center for Next Generation Manufacturing (advanced manufacturing student educator resources)
  https://www.nextgenmfg.org/
- The Manufacturing Institute Innovators Quest (manufacturing project teamwork problem solving careers)
  https://themanufacturinginstitute.org/students/innovators-quest/

16. Leadership

- SkillsUSA (student leadership career readiness manufacturing technical education)
  https://www.skillsusa.org/
- Lead4Change (student leadership teamwork communication problem solving)
  https://lead4change.org/
- CCCS Open Textbooks Teamwork and Leadership (organizational communication teamwork leadership basics)
  https://pressbooks.ccconline.org/2250organizationalcommunication/chapter/teamwork-and-leadership/
- OPM Federal Leadership Development Programs (leadership development programs goal setting professional growth)
  https://www.opm.gov/policy-data-oversight/training-and-development/federal-leadership-development-programs/

17. Work-Based Learning

- Perkins Collaborative Resource Network Work-Based Learning Toolkit (work-based learning program design employer engagement student experiences)
  https://cte.ed.gov/wbltoolkit/index.html
- NAF Work-Based Learning (career-connected learning internships job shadows mentorship)
  https://ash.naf.org/public/wbl
- ACTE Work-Based Learning State Resources (Colorado work-based learning guides frameworks professional organizations)
  https://www.acteonline.org/about/structure/divisions/work-based-learning-division/wbl-state-resources/
- U.S. Department of Education CTE and Work-Based Learning (career-connected learning apprenticeships internships CTE pathways)
  https://www.ed.gov/about/homeroom-blog/expanding-meaningful-school-choice-through-cte-and-work-based-learning

Technology Student Association – National Competitive Events

Manufacturing Prototype

Objective: *Students will design, document, fabricate, evaluate, and present a manufactured prototype that meets TSA Manufacturing Prototype requirements for production quality, technical documentation, materials, and product communication.*

- Research the annual TSA Manufacturing Prototype challenge and identify the product requirements, constraints, and intended audience.
- Develop a prototype concept using sketches, CAD models, technical drawings, or other design-planning tools.
- Create working drawings, detail drawings, a parts list, and documentation needed to communicate the design.
- Fabricate a prototype using appropriate manufacturing processes, materials, tools, equipment, and components.
- Document construction, testing, revisions, strengths, weaknesses, materials, and production decisions in a portfolio.
- Prepare a bill of materials and work log that communicate the manufacturing process.
- Present a sales pitch explaining the product, design decisions, production process, cost considerations, and final prototype.

Resources

- Technology Student Association – Manufacturing Prototype competition guidelines https://tsaweb.org/competitions-programs/tsa/themes-problems
- Autodesk Fusion – CAD/CAM design and manufacturing tools https://www.autodesk.com/products/fusion-360/education
- Onshape Education – Browser-based CAD and product design tools https://www.onshape.com/en/education/
- Xometry – Manufacturing and prototyping process resources https://www.xometry.com/resources/

Technology Student Association – National Competitive Events

System Control Technology

Objective: *Students will design, construct, program, troubleshoot, document, and demonstrate a working control-system solution that responds to a TSA-provided problem.*

- Interpret the TSA-provided control-system problem and identify the required functions, constraints, and performance goals.
- Design a system that uses inputs, outputs, circuits, sensors, motors, controls, feedback, or programmable components.
- Create a program or control sequence that allows the system to operate as intended.
- Construct and test the system using approved materials, tools, electronics, and safety procedures.
- Troubleshoot mechanical, electrical, sensor, programming, or feedback-loop issues to improve system performance.
- Maintain an inventor's log documenting design decisions, testing, revisions, and final system operation.
- Demonstrate the completed system and explain how the design meets the problem criteria during judge evaluation.

Resources

- Technology Student Association – System Control Technology competition guidelines https://tsaweb.org/competitions-programs/tsa/themes-problems
- Arduino Education – Electronics and control systems https://www.arduino.cc/education
- VEX Robotics STEM Labs – Mechanisms, sensors, and programming https://education.vex.com/
- Tinkercad Circuits – Circuit simulation and prototyping https://www.tinkercad.com/circuits

Technology Student Association – National Competitive Events

Computer-Aided Design (CAD), Engineering

Objective: *Students will use CAD tools and technical design practices to solve an engineering design problem and produce accurate three-dimensional representations of an engineering subject.*

- Analyze the TSA CAD Engineering design problem and determine the required engineering subject or product solution.
- Create a CAD-based solution using appropriate three-dimensional modeling tools and technical drawing practices.
- Apply dimensions, annotations, views, and design conventions that communicate the engineering solution accurately.
- Work independently during the competition design session to produce an original solution.
- Save, manage, and submit digital CAD files according to TSA event procedures.
- Explain the design solution, technical decisions, and CAD process during a brief interview.
- Evaluate the final design using TSA criteria for accuracy, completeness, technical quality, and communication.

Resources

- Technology Student Association – Computer-Aided Design (CAD), Engineering competition guidelines
  https://tsaweb.org/competitions-programs/tsa/themes-problems
- Autodesk Fusion – CAD/CAM tools for design and fabrication
  https://www.autodesk.com/products/fusion-360/education
- SOLIDWORKS Education
  https://www.solidworks.com/solution/education
- Onshape Education
  https://www.onshape.com/en/education/