Arizona CTE

Engineering Technical Standards

INVESTIGATE THE FIELD OF ENGINEERING TO ADDRESS THE NEEDS OF A GLOBAL SOCIETY ENG1.0

1. Define the disciplines of engineering (types of engineers) (i.e., chemical, civil, electrical, mechanical, agricultural, industrial, aeronautical, software, biomedical, etc.) ENG1.1
2. Recognize that engineers solve a wide range of problems involving innovation, cost reduction, and more efficient/effective processes ENG1.2
3. Describe the specialties/areas of training that may lead to jobs/careers (i.e., transportation, construction, research and development, analytical design, disaster management, waste management, environmental, automation and robotics, etc.) ENG1.3
4. Explore emerging fields in engineering and challenges to future work and future life [i.e., drones, electric cars, autonomous cars, AI, IoT, Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), Additive Manufacturing (AM), Smart City design, Automation, Machine Learning (ML), M2M (Machine-to-Machine), H2M (Human-to-Machines), etc.] ENG1.4
5. Analyze the societal, environmental, legal, and ethical responsibilities of engineers (e.g., Engineering Code of Ethics, economic, political, sustainability, and community health and safety) ENG1.5
6. Determine the skills and education required to enter engineering careers (i.e., aptitude for math and science; complex problem solving, critical thinking and decision-making; interpreting plans, schematics, and blueprints; communication skills to influence and convey facts with specificity, etc.) ENG1.6

CREATE ENGINEERING SOLUTIONS BY APPLYING A STRUCTURED PROBLEM-SOLVING/DECISIONMAKING PROCESS ENG2.0

1. Identify the problem ENG2.1
2. Develop a problem statement based on facts, research, and experience ENG2.2
3. Explore possible issues or options to the problem ENG2.3
4. Select the best solution within the constraints and criteria ENG2.4
5. Develop a prototype or model to test the selected solution ENG2.5
6. Implement the solution ENG2.6

	7 Evaluate the solution, and revise or repeat if necessary (i.e., Are there other solutions, better solutions, or cheaper solutions? etc.) ENG2.7
	8 Document and report all results ENG2.8
APPLY MATHEMATICAL LAWS AND PRINCIPLES RELEVANT TO ENGINEERING TECHNOLOGY ENG3.0	1 Use basic mathematical functions and tools (i.e., Google Sheets, Excel, graphing calculator, etc.) ENG3.1
	2 Use data collection and analysis to display data and verify its accuracy ENG3.2
	3 Display data graphically using diagrams and working drawings ENG3.3
	4 Use statistical measures of a central tendency (mean, median, and mode) as needed in the structured problem-solving process ENG3.4
	5 Use mathematical models including algebraic, geometric, trigonometric, and calculus relationships to solve, analyze, and design solutions ENG3.5
	6 Generate manually and electronically mathematical solutions and evaluate their validity ENG3.6
	7 Use English and Metric systems of measurement ENG3.7
APPLY SCIENTIFIC LAWS AND PRINCIPLES RELEVANT TO ENGINEERING TECHNOLOGY ENG4.0	1 Use the relationship among energy, work, and power to solve a variety of problems involving mechanical, fluid, electrical, and thermal systems ENG4.1
	2 Use Newton's Laws of Motion to analyze static and dynamic systems with and without the presence of external forces ENG4.2
	3 Use the laws of conservation of energy, charge, and momentum to solve a variety of problems involving mechanical, fluid, electrical, and thermal systems ENG4.3
	4 Analyze relevant properties of materials used in engineering projects [i.e., chemical, environmental, mechanical (tension, compression, torque), electrical, physical, etc.] ENG4.4
APPLY TECHNOLOGY AND TOOLS TO ENGINEERING SOLUTIONS ENG5.0	1 Explain the concepts of precision, accuracy, and tolerance as they relate to measurement tools (i.e., micrometers, dial indicator, digital calipers, etc.) ENG5.1
	2 Use measurement devices such as calipers, oscilloscopes, and digital multimeters to gather data for analysis ENG5.2
	3 Verify the calibration status of measurement tools (i.e., quality control, test, and retest, etc.) ENG5.3
	4 Use software tools to solve, model, analyze, and/or design solutions to engineering problems (i.e., SOLIDWORKS, AutoCAD, On-shape, Fusion360, Google Sheets, Excel, etc.) ENG5.4

	5 Identify hazards, risks, and incidents related to tools and equipment ENG5.5
	6 Practice safe use of tools, machines, equipment, and materials (i.e., OSHA, SDS sheets, PPE, etc.) ENG5.6
	7 Review fabrication methods to create potential solutions to engineering problems (e.g., 3D printing, injection molding, woodworking, and welding) ENG5.7
APPLY COMMUNICATION SKILLS TO ENGINEERING PROJECTS ENG6.0	1 Apply technical writing skills and use visual aids to present critical information in reports (i.e., results/outcomes, conclusions, future work recommendations, etc.) ENG6.1
	2 Utilize the three stages of oral presentation (e.g., planning, practicing, and presenting) ENG6.2
	3 Apply communication skills, including listening skills, with project teams, project managers, clientele, and/or contractors ENG6.3
	4 Explain the importance of multiculturalism in creative and professional decision-making (e.g., better decisions based on different views, perspectives, ideas, and proposals; fosters critical thinking, analysis, and collaboration) ENG6.4
APPLY PROJECT MANAGEMENT TOOLS AND TECHNIQUES TO ENGINEERING SOLUTIONS ENG7.0	1 Determine the tools, materials, manpower, and money allocation required to manage the project ENG7.1
	2 Utilize time-management techniques (e.g., prioritizing and planning, creating goals, scheduling, advocating, and taking action) ENG7.2
	3 Organize and maintain work using project management tools (e.g., Gantt Chart, AGILE, Kanban, Waterfall model, dashboards, task lists, project reports, and time sheets) ENG7.3
	4 Schedule daily/weekly meetings to check status of the project and to deal with any constraints and obstacles to the project ENG7.4
	5 Document and present project results/outcomes as appropriate ENG7.5
	6 Analyze the project from various perspectives (i.e., sustainability, political, economic, health and safety perspectives, etc.) ENG7.6