Science, Technology, Engineering and Mathematics

Pathway: Engineering and Technology

Code	Topic	Course	Knowledge and Skill	Performance Element	Measurement Criteria
SCPA01.01	Academic Foundations	#4: Product Engineering and Development #8: Engineering Analysis	Apply concepts and processes as defined by the National Council of Teachers of Mathematics in Principles and Standards for School Mathematics.	Choose and or create models that can be used to solve problems.	Recognize appropriate models, concepts, and processes for the situation, and apply them in solving the problem.
					Explain the impact of assumptions, initial conditions, boundary conditions, and other constraints on problem solutions.
					Use algebraic, geometric and trigonometric relationships, characteristics, and properties to solve problems.
					Evaluate mathematical solutions for reasonableness.
				Select and use appropriate statistical methods to analyze data to help make decisions.	Apply appropriate data collection and analysis methods and means of displaying data.
					Apply concepts of probability to help make decisions.
					Apply concepts of data collection and displaying data.
SCPA01.02	Academic Foundations	Calculus Physics	Apply concepts and processes as defined by the National Research Council in the National Science Education Standards, and by the American Association for the Advancement of Science in Benchmarks for Science Literacy.	Use systems of measurement.	Convert units of measurement from one system to the other.
					Use measurement systems to solve problems.
				Differentiate between scalar and vector quantities.	List quantities that can be represented by scalar and vector.
					Describe the relations between position, velocity, and acceleration in vector terms.

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			(CONTINUED)	Apply fundamental laws and principles relevant to engineering and technology.	Use Newton's Laws of motion to analyze static and dynamic systems with and without the presence of external forces.
					Use the laws of conservation of energy, charge, and momentum to solve a variety of problems involving mechanical, fluid, chemical (atomic), nuclear, biological, electrical, and thermal systems.
					Use the relationships between energy, work, and power to solve a variety of problems involving mechanical, fluid, electrical, and thermal systems.
					Use the principles of ray optics to describe reflection and refraction of light.
					Identify relevant chemical, mechanical, biological, electrical, and physical properties of materials used in engineering projects.
					Describe the relations between amplitude, wavelength, frequency, period, and speed of a wave.
					Explain the relationships between scientific theory, scientific principles and laws, and technology.

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SCPA01.03	Academic Foundations	#10: Engineering Processes	Apply concepts and processes as defined in the Standards for Technological Literacy: Content for the Study of Technology.	Use mathematics, science and technology concepts and processes to solve problems quantitatively in engineering projects involving design, development, or production in various technologies.	Explain and apply concepts in medical technologies.
					Explain and apply concepts in agricultural and related biotechnologies.
					Explain and apply concepts in energy and power technologies.
					Explain and apply concepts in information and communication.
					Explain and apply concepts in transportation technologies.
					Explain and apply concepts in manufacturing technologies.
					Explain and apply concepts in construction technologies.
				Apply the core concepts of technology and recognize their relationships with engineering, science and math, and other subjects.	Explain and apply the core concepts of systems in technology and engineering projects.
					Explain and apply the core concepts of resources in technology and engineering projects.
					Explain and apply the core concepts of criteria and constraints in technology and engineering projects.
					Explain and apply the core concepts of optimization and trade-off in technology and engineering projects.
					Explain and apply the core concepts of processes in technology and engineering projects.
					Explain and apply the core concepts of controls in technology and engineering projects.

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SCPA04.01	Information Technology Applications	#3: Information Technology Applications #8: Engineering Analysis	Use information technology applications.	Use computer applications to solve problems.	Create and use algorithms.
					Use simulation, modeling, prototype techniques to solve problems.
				Select and use different forms of communications technology.	Use word processing, spreadsheet, database and presentation software.
					Use the Internet to search for and display information.
					Use e-mail to communicate.
				Collect, manage, display data.	Use probes and sensors to collect data.
					Create engineering drawings.
					Select and use Information Technology tools to analyze and synthesize data.
SCPA04.02	Information Technology Applications	#3: Information Technology Applications #8: Engineering Analysis	Manage, develop, and improve Information Technology (IT) tools.	Develop and deploy information technology tools.	Select and use IT tools that are compatible with existing and emerging systems.
					Apply protocols for hardware communication (e.g. networking).
					Adapt/deploy technical support strategies.
					Analyze system feedback and take appropriate action.
SCPA10.01	Technical Skills	#10: Engineering Processes	Apply technological content concepts, and principles.	Discover how things work.	Demonstrate knowledge of technology and troubleshooting.
					Use problem solving in engineering and technology.
					Be able to distinguish between hardware/software problems.

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			(CONTINUED)	Use appropriate “tools of the trade.”	Apply concepts of planning.
					Apply concepts of designing.
					Apply concepts of building.
					Apply concepts of testing.
					Apply concepts of quality assurance.
					Apply concepts of customer needs.
					Use measuring systems, devices.
					Correlate quality practices with business
					Use appropriate modeling tools.
				Differentiate between related elements of engineering and technology.	Conduct research and development.
					Conduct experimentation and application.
					Practice invention and innovation.
					Apply principles of theory and fact.
SCPA10.02	Technical Skills	#10: Engineering Processes	Model technical competence.	Use effective project and system management.	Apply the processes needed to complete a project.
					Develop and implement a plan for a project.
					Contribute as a team member in completing a project.
					Predict end results.
					Determine changes needed in a process or product to meet a change in design, constraints, or requirements.
					Use appropriate time management practices.
					Apply effective organizational skills.
				Use precision measuring methods and instruments.	Record data with the correct number of significant figures.
					Explain the impact of error and uncertainty in measurement.
					Predict the effect of error propagation in calculations.

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			(CONTINUED)	Safely operate and use a variety of tools, machines, equipment and materials.	Handle and store tools and materials correctly.
					Perform basic maintenance.
					Describe the results of negligent or improper maintenance, or of improper calibration.
				Apply elements of engineering and technology.	Conduct analysis of costs, resources, production capacity, customer satisfaction, quality.
					Use appropriate problem-solving techniques.
					Use optimization.
SCPA11.01	Design	#7: Engineering Innovation #9: Engineering Design	Examine elements of the design process.	Examine the history of innovation and invention.	Define innovation and invention.
					Research the history of inventors and innovators.
					Research the interrelationship between society and innovation.
				Apply concepts of design.	Examine attributes of design in systems.
					Examine attributes of design in products.
					Examine attributes of design in services.
					Examine design constraints in regard to manufacturability.
					Examine design constraints in regard to testability.
					Examine design constraints in regard to maintainability.
					Examine design constraints in regard to cost.
					Examine design constraints in regard to human resources.
					Examine design constraints in regard to environmental factors.
					Examine design constraints in regard to technology.
					Identify design trends.
					Examine trade-offs.

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SCPA11.02	Design	#9: Engineering Design	Demonstrate and apply the design process.	Design a system, product or service.	Interpret and produce design criteria.
					Solve a problem to achieve given specifications with considerations to constraints.
					Incorporate human, environmental and technological factors in the design process.
					Apply risk analysis in the design process.
					Employ reverse engineering principles.
				Access, test, record, organize and evaluate information needed to alter the design of a product, system or service.	Interpret and evaluate accuracy of information.
					Improve a product, service or system to meet requirements based on feedback and analysis.

Additional Recommended CTE/Degree Major Courses:

#5: Digital Electronics

#6: Civil Engineering and Architecture