



Science, Technology, Engineering and Mathematics

Foundation

Code	Topic	Course	Knowledge and Skill	Performance Element	Measurement Criteria
SCC02.01	Communications	English/Language Arts Courses	Demonstrate effective oral, written, and visual communication.	Discuss effective methods to communicate essential concepts to diverse audiences.	Write and report subjective and objective information.
					Write and report information with the intent of being persuasive.
					Write and report information with the intent of being informative.
					Write and report information with the intent of being instructive.
					Analyze the audience and presentation environment.
					Explain technical concepts to non-technical audiences.
					Use professional terminology.
					Identify, select, and use appropriate multimedia resources.
				Effectively communicate scientific, technological, engineering, or mathematical information to the intended audience.	Apply active listening skills using reflection, restatement, questioning, and clarification.
					Discern between various communication techniques and their abilities to convey various types of information.
					Prepare scientific, technological, engineering, or mathematical reports using oral presentation skills.
					Prepare scientific, technological, engineering, or mathematical reports using written presentation skills.
					Prepare scientific, technological, engineering, or mathematical reports using visual presentation skills.
					Prepare scientific, technological, engineering, or mathematical reports using multimedia presentation skills.
Explain the various methods of giving and obtaining information.					

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			(CONTINUED)	Read, interpret, and analyze technical materials, discerning information and concepts.	Use appropriate note-taking methods. Write and/or present a report on technical literature; use graphical tools as appropriate. Discriminate between fact and opinion. Seek clarity of communication by rephrasing, questioning and summarizing. Validate understanding and provide and or obtain constructive feedback.
SCC04.01	Information Technology Applications	#3: Information Technology Applications	Use information technology to gather, store, apply and communicate data.	Use information technology as it supports the gathering, storage, and transfer of data and information. Select and use different forms of information technology.	Apply different techniques for gathering, storing, and transferring data. Select and use appropriate tools to analyze and synthesize data. Describe the meaning of probability and how it applies to a set of data. Use computer to conduct research. Write a report based on Internet research, using calculations, graphs, and/or spreadsheets. Use simulation, modeling, and/or prototype techniques to solve problems. Create, organize, manage, and distribute electronic information. Apply technology to visualize a problem.
SCC04.02	Information Technology Applications	#3: Information Technology Applications	Evaluate the different technological tools used to manipulate and model data.	Use information technology tools to manipulate and create information from data.	Use statistical tools to analyze data. Query and extract information from data. Create knowledge from data.

Code	Topic	Course	Knowledge and Skill	Performance Element	Measurement Criteria
			(CONTINUED)	Use modeling, simulation, and visualization to efficiently analyze, synthesize and communicate information.	Apply techniques for modeling systems or problems. Apply techniques for scientific visualization and animation of complex physical systems or problems. Test different scenarios to multiple variables.
				Apply current computer programming languages.	Write and execute a simple program (e.g., Basic, Java, C++).
				Use statistical tools to show reliability of data.	Using a selected statistical tool, compute data reliability.
SCC06.01	Safety, Health, and Environmental	#2: Principles of Engineering #2: Laboratory Practices and Biology Laboratory	Apply safety practices in your environment.	Develop good safety and health practices.	Exercise good safety practices. Follow various regulatory codes, such as EPA, FEMA, UL, OSHA, and CSA. Reference and use material safety data sheets (MSDS). Encourage others to employ safe practices.
				Use appropriate safety techniques, equipment, and procedures.	Develop and implement emergency plans. Develop and implement workplace lab safety plan. Follow workplace regulations and record-keeping requirements. Use safety equipment in the workplace. Use eyewash and safety showers. Accurately interpret safety signs, symbols, and labels. Demonstrate basic first aid. Use tools and equipment safely.
SCC06.02	Safety, Health, and Environmental	#2: Principles of Engineering #2: Laboratory Practices and Biology Laboratory	Develop a broad awareness of safety, health, and environmental hazards.	Identify existing and potential hazards to safety, health, and environment.	Describe potential safety, health and environmental hazards in various situations. Identify physical, chemical, toxicological, biological, and radioactive hazards.

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SCC06.03	Safety, Health, and Environmental	#2: Principles of Engineering #2: Laboratory Practices and Biology Laboratory	Engage in continuous improvement of environmental, health and safety practices.	Provide feedback and analysis to those in charge of environmental, health and safety practices.	Analyze environmental impacts.
					Conduct a safety audit.
					Assess the impact of unsafe practices.
					Apply appropriate corrective action.
					Develop new safety practices and procedures for new and existing technology.
SCC07.01	Leadership and Teamwork	#4: Product Engineering and Development #6: Scientific Research	Participate effectively on a team.	Work effectively with others from diverse backgrounds.	Identify the challenge of barriers when working on a diverse team.
					Work effectively with multi-disciplinary teams.
					Develop consensus for best outcome.
				Exercise the ability to lead or follow in a team environment.	Describe leadership skills necessary to bring a team to consensus on a new method of working.
					Appropriately give/take credit and responsibility.
					Divide tasks among a team of three, with no designated leader.
					Demonstrate various management skills (e.g., strategies, collaborative, resourcefulness, flexibility) and decision-making models.
					Communicate effectively verbally and non-verbally with team colleagues.
					Exhibit a strong sense of team identity and commitment to purpose.
					Act responsibly as a team member, completing assigned tasks in a timely and effective manner.
					Respond to critical situations appropriately as a member of a team.
					Delegate tasks, responsibility, and authority as appropriate.
					Follow up on tasks delegated to others.
					Recognize and reward individual and team contributions.
Collaborate with others to formulate team objectives.					

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SCC07.02	Leadership and Teamwork	#4: Product Engineering and Development #6: Scientific Research	Understand how and when to form teams.	Exercise leadership and teamwork skills.	Analyze the need for a team. Identify roles of team members. Recognize individual abilities and the importance of forming teams with others whose abilities are complementary. Know how and when to move people in and out of the team environment. Recognize characteristics of effective teams. Explain the role of a team on a project. Use teamwork skills to achieve goals, solve problems, and manage conflict. Be involved in mentor/mentored relationships. Give and receive feedback constructively.

Code	Topic	Course	Knowledge and Skill	Performance Element	Measurement Criteria
SCC08.01	Ethics and Legal Responsibilities	#2: Principles of Engineering #2: Laboratory Practices and Biology Laboratory	Know current ethical and legal standards in the scientific, mathematics, engineering, and technology communities.	Adhere to ethical and legal standards.	<p>Evaluate the pros and cons of current ethical questions and scenarios; for example, environmental stewardship, genetic research, and living subjects in research.</p> <p>Make ethical decisions when presented with ethical choices or moral dilemmas.</p> <p>Comply with ethical standards (code of ethics) for your field.</p> <p>Follow legal requirements for the treatment of people in the workplace (ADA, EEO).</p> <p>Follow requirements of regulatory agencies in the scientific, and mathematics, engineering, or technology field (e.g., NFPA, OSHA, EPA, ADA, EOE, and FCC).</p> <p>Develop personal ethics for real-life situations/experiences in science, technology, engineering, and mathematics.</p> <p>Evaluate personal, professional, and organizational ethics.</p> <p>Explain fundamentals of patents, trademarks, copyrights, and proprietary information.</p> <p>Compare and contrast personal ethical values with various professional and organizational codes of ethics.</p> <p>Recognize and refute misleading information.</p> <p>Evaluate methods for protecting and conserving resources.</p>

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SCC09.01	Employability and Career Development	#1: Introduction to Engineering Design #1: Introduction to Careers	Identify patterns, relations, and functions of an organization or a workplace.	Study the essential parts of an organization or a workplace for the purpose of future employment.	Demonstrate ability to gather information about an organization.
					Evaluate and compare employment or advancement opportunities.
SCC09.02	Employability and Career Development	#1: Introduction to Engineering Design #1: Introduction to Careers	Exhibit continuous improvement for personal and professional growth.	Develop skills and knowledge for career growth.	Identify and participate in continuous education opportunities.
					Engage in continuous self-assessment and goals modification for personal and professional growth.
					Participate in professional or trade organizations.
				Identify performance expectations of a job.	Practice good work habits/time management.
					Be a team player.
					Demonstrate respectful behavior in workplace.
					Maintain knowledge and skills.
Describe benefits of certifications for various career paths.					
SCC09.03	Employability and Career Development	#1: Introduction to Engineering Design #1: Introduction to Careers	Research career pathways in science, technology, engineering, and mathematics.	Engage in a large variety of science, technology, engineering, or mathematics experiences to determine personal interest in respective pathways.	List resources for researching funding sources for scientific projects and technology.
					List careers that you have investigated, internships that you could apply for, and job shadowing opportunities that you have identified.
					Construct and maintain a portfolio of experiences and accomplishments.

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.
				Select and use appropriate statistical methods to analyze data to help make decisions.	Evaluate mathematical solutions for reasonableness.
					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.	<p>Use Newton's Laws of motion to analyze static and dynamic systems with and without the presence of external forces.</p> <p>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.</p> <p>Use the relationships between energy, work, and power to solve a variety of problems involving mechanical, fluid, electrical, and thermal systems.</p> <p>Use the principles of ray optics to describe reflection and refraction of light.</p> <p>Identify relevant chemical, mechanical, biological, electrical, and physical properties of materials used in engineering projects.</p> <p>Describe the relations between amplitude, wavelength, frequency, period, and speed of a wave.</p> <p>Explain the relationships between scientific theory, scientific principles and laws, and technology.</p>

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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.
					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

Science, Technology, Engineering and Mathematics

Pathway: Science and Mathematics

Code	Topic	Course	Knowledge and Skill	Performance Element	Measurement Criteria
SCPB01.01	Academic Foundations	#7: Science and Mathematics in the Real World	Understand how science and mathematics function as an active component of the real world.	Apply science and mathematics concepts and principles of inquiry.	Describe the inquiry process and apply the skills necessary to engage in inquiry.
					Apply the methods and tools for research and investigation.
					Conduct experiments in a laboratory.
				Use a broad knowledge of science and mathematics to communicate with the global community.	Acquire competency in foundation science and mathematics subjects such as physical science, biological science, chemical science, mathematical science, and social science.
					Write and/or graphically describe the interrelationship of an individual to his/her organization and overall environment.
					Broaden knowledge and skills in science and mathematics through co-op/internship experiences, science fairs, reading publications, job shadowing, and continuing education.
					Interact and communicate with the scientific community.
					Communicate and contribute to broader community and society in a meaningful way.
				Access, share and use data.	Apply techniques for observation and gathering data.
					Apply techniques for creating data.
Apply techniques for processing and interpreting data.					
Apply techniques for sharing data.					
					Explain the advantages and disadvantages of using various technological tools in data management.

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			(CONTINUED)	Integrate science, mathematics, technology, and engineering concepts and content.	Write or describe graphically the interdependency of science, mathematics, technology, and engineering concepts and content.
SCPB01.02	Academic Foundations	#8: Advanced Applications of Science and Mathematics	Apply essential concepts and skills for proficiency in science and mathematics in real-world situations.	Apply the scientific method.	Apply data analysis methods.
					Apply basic scientific research.
					Construct a testing model.
					Organize records and files to maintain data.
					Define hypothesis.
				Recognize cause and effect.	Graph a dependent versus independent variable.
					Write a report illustrating cause and effect phenomena in the physical environment.
				Differentiate between science and pseudoscience.	Define science and pseudoscience.
					Compare and contrast science and pseudoscience.
				Draw a conclusion from a series of observations.	Write a report that details how your conclusion is supported by a series of observations.
				Recognize measurable attributes of objects, units, systems and processes.	List examples of measurable attributes for objects, units, systems, and processes.
					Solve a linear set of equations for unknowns.
				Analyze change in various contexts.	List examples of change and its context, in science, and in mathematics.
Research a topic.	Compile research about the topic.				
	Develop research report.				
	Present research report.				

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			(CONTINUED)	Organize problems into manageable parts.	Write an outline of an approach to researching a problem, illustrating how to organize the problem into manageable parts.
				Use qualitative and quantitative skills to conduct a simple scientific survey.	Present a summary of the results of a simple scientific survey.
				Predict outcomes of an experiment.	Write a statement describing a null hypothesis.
				Defend opinions using fact.	Write a paragraph in which the topic sentence states an opinion that is supported by three statements of fact.
SCPB01.03	Academic Foundations	#7: Science and Mathematics in the Real World	Assess the impact that science and mathematics has on society.	Evaluate the impact of science on society.	Write an essay describing the impact of science on society.
				Evaluate the impact of mathematics on society.	Write an essay describing the impact of mathematics on society.
				Investigate how science and mathematics influence professions and occupations within the cluster.	Select a profession or an occupation and describe its relationship to science or mathematics.
SCPB03.01	Problem Solving and Critical Thinking	#9: Using Science and Mathematics to Solve Problems	Use scientific and mathematical problem-solving skills to produce viable solutions to problems.	Demonstrate effective problem-solving techniques.	Identify the solution to a specific problem.
					Develop a project plan and timeline.
					Make efficient use of time and resources to complete work.
				Apply appropriate scientific methodology.	Use scientific method to research/investigate a specific scientific or mathematical problem.
					Form a problem statement.
					Construct a solution to a problem.
				Use analytical tools and techniques to solve problems, construct tests, and evaluate data.	Evaluate data.
					Construct an appropriate statistical test.
					Apply scientific and mathematical principles to a qualitative problem.
					Analyze a problem.

Code	Topic	Course	Knowledge and Skill	Performance Element	Measurement Criteria
SCPB03.02	Problem Solving and Critical Thinking	#9: Using Science and Mathematics to Solve Problems	Use critical thinking skills to translate, interpret, and summarize research and statistical data.	Use effective critical thinking skills.	Translate, interpret, and summarize research and statistical data.
					Draw a conclusion based on observations and experimental results.
					Recognize, verify, and implement an appropriate solution to a problem.
					Break down a complex scientific system into basic components.
					Identify weaknesses/defects within a system and propose solutions.
SCPB10.01	Technical Skills	#10: Technical Aspects of Science and Mathematics	Demonstrate knowledge and application of technical skills needed in a chosen scientific and mathematical field.	Design, operate, and maintain technological systems and equipment.	Engage in technical certification and continuous education opportunities in design, operation, and maintenance.
					Collect information, change/modify materials, and conduct experiments, using appropriate tools.
					Write a report describing how to collect information, change/modify materials, conduct experiments, using appropriate tools.
					Use appropriate tools for a given application.
					Calibrate equipment.
Determine appropriate uses of technology.	Provide examples of scientific or mathematical technology and their uses.				
Critically evaluate data.	Summarize data evaluations.				