Science, Technology, Engineering and Mathematics: Engineering and Technology
Career Pathway Plan of Study for ▶ Learners ▶ Parents ▶ Counselors ▶ Teachers/Faculty

This Career Pathway Plan of Study (based on the Engineering and Technology Pathway of the Science, Technology, Engineering and Mathematics Career Cluster) can serve as a guide, along with other career planning materials, as learners continue on a career path. Courses listed within this plan are only recommended coursework and should be individualized to meet each learner's educational and career goals.
**This Plan of Study, used for learners at an educational institution, should be customized with course titles and appropriate high school graduation requirements as well as college entrance requirements.*

EDUCATION LEVELS	GRADE	English/ Language Arts	Math	Science	Social Studies/ Sciences	Other Required Courses Other Electives Recommended Electives Learner Activities	*Career and Technical Courses and/or Degree Major Courses for Engineering and Technology Pathway	SAMPLE Occupations Relating to This Pathway
	Interest Inventory Administered and Plan of Study Initiated for all Learners							
SECONDARY	9	English/ Language Arts I	Algebra I or Geometry	Biology	State History Civics	All plans of study should meet local and state high school graduation requirements and college entrance requirements. Certain local student organization activities are also important including public speaking, record keeping and work-based experiences.	• Introduction to Engineering Design	▶ Aeronautical Engineer ▶ Aerospace Engineer ▶ Agricultural Engineer ▶ Agricultural Technician ▶ Application Engineer ▶ Architectural Engineer ▶ Automotive Engineer ▶ Biomedical Engineer ▶ Biotechnology Engineer ▶ CAD Technician ▶ Chemical Engineer ▶ Civil Engineer ▶ Communications Engineer ▶ Computer Engineer ▶ Computer Programmer ▶ Construction Engineer ▶ Electrical Engineer ▶ Electronics Technician ▶ Geothermal Engineer ▶ Industrial Engineer ▶ Manufacturing Engineer ▶ Manufacturing Technician ▶ Marine Engineer ▶ Mechanical Engineer ▶ Metallurgist ▶ Mining Engineer ▶ Nuclear Engineer ▶ Petroleum Engineer ▶ Product/Process Engineer ▶ Survey Technician ▶ Systems Engineer ▶ Transportation Engineer
	10	English/ Language Arts II	Geometry or Algebra II	Chemistry	U.S. History		• Principles of Engineering • Information Technology Applications	
	11	English/ Language Arts III	Algebra II or Trigonometry Pre-Calculus or Statistics	Physics	World History World Geography		• Product Engineering and Development • Digital Electronics	
	College Placement Assessments-Academic/Career Advisement Provided							
	12	English/ Language Arts IV	Trigonometry or Pre-Calculus/ Calculus or AP Calculus or Math Analysis	AP Science or Structured Computer Program Language	Economics Entrepreneurship		• Civil Engineering and Architecture • Engineering Innovation	
	Articulation/Dual Credit Transcripted-Postsecondary courses may be taken/moved to the secondary level for articulation/dual credit purposes.							
POSTSECONDARY	Year 13	English Composition English Literature	Algebra or Trigonometry Calculus I Calculus II	Chemistry Physics I	Psychology Global Issues	All plans of study need to meet learners' career goals with regard to required degrees, licenses, certifications or journey worker status. Certain local student organization activities may also be important to include.	• Engineering Analysis • Engineering Design	
	Year 14	Speech/ Oral Communication Professional and Technical Writing	Introduction to Differential Equations Calculus III Statistics	Physics II Biology	American History Sociology Ethics and Legal Issues		• Engineering Processes	
	Year 15	Continue courses in the area of specialization.					• Continue Courses in the Area of Specialization	
	Year 16						• Complete Engineering and Technology Major (4-Year Degree Program)	

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SAMPLE

Creating Your Institution's Own Instructional Plan of Study

With a team of partners (secondary/postsecondary teachers and faculty, counselors, business/industry representatives, instructional leaders, and administrators), use the following steps to develop your own scope and sequence of career and technical courses as well as degree major courses for your institution's plan of study.

1 Crosswalk the Cluster Foundation Knowledge and Skills (available at **http://www.careerclusters.org/goto.cfm?id=96**) to the content of your existing secondary and postsecondary programs/courses.

2 Crosswalk the Pathway Knowledge and Skills (available at **http://www.careerclusters.org/goto.cfm?id=73**) to the content of your existing secondary/postsecondary programs and courses.

3 Based on the crosswalks in steps 1 and 2, determine which existing programs/courses would adequately align to (cover) the knowledge and skills. These programs/courses would be revised to tighten up any alignment weaknesses and would become a part of a sequence of courses to address this pathway.

4 Based on the crosswalks in steps 1 and 2, determine what new courses need to be added to address any alignment weaknesses.

5 Sequence the **content** and **learner outcomes** of the existing programs/courses identified in step 3 and new courses identified in step 4 into a course sequence leading to preparation for all occupations within this pathway. (See list of occupations on page 1 of this document.)

6 The goal of this process would be a series of courses and their descriptions. The names of these courses would be inserted into the *Career and Technical Courses* column on the Plan of Study on page 1 of this document.

7 The SAMPLE on page 4 is a **sample result** of steps 1-6, and these course titles are inserted into the Plan of Study on page 1 of this document.

8 Crosswalk your state academic standards and applicable national standards (e.g., for mathematics, science, history, language arts, etc.) to the sequence of courses formulated in step 6.

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SAMPLE Sequence of Courses for ▶ Instructional Leaders ▶ Administrators ▶ Counselors ▶ Teachers/Faculty

Below are suggested courses that could result from steps 1-6 above. However, as an educational institution, course titles, descriptions and the sequence will be your own. This is a good model of courses for you to use as an example and to help you jump-start your process. Course content may be taught as concepts within other courses, or as modules or units of instruction.

The following course is based on the Cluster Foundation Knowledge and Skills found at http://www.careerclusters.org/goto.cfm?id=96. These skills are reinforced through participation in student organization activities.

#1

Introduction to Engineering Design: This course helps students understand the field of engineering/engineering technology. Students are encouraged to use a problem-solving model to improve existing products and invent new ones. They learn how to apply this model to solve any problems, even outside of the classroom. Students use sophisticated three-dimension modeling software to communicate the details of these products. Emphasis is placed on analyzing potential solutions and communicating ideas to others. This may be taught as a career exploration course in conjunction with other foundation Career Cluster courses.

The following courses are based on the Cluster Foundation Knowledge and Skills as well as the Pathway Knowledge and Skills found at http://www.careerclusters.org/goto.cfm?id=73. These skills are reinforced through participation in student organization activities.

#2

Principles of Engineering: This course helps students explore various technology and manufacturing processes and systems to learn how engineers and technicians use mathematics, science and technology in an engineering problem-solving process to benefit people. This course also includes concerns about social and political consequences of technological change.

#3

Information Technology Applications: Students will use technology tools to manage personal schedules and contact information, create memos and notes, prepare simple reports and other business communications, manage computer operations and file storage, and use electronic mail, Internet applications and GIS to communicate, search for and access information. Students will develop skills related to word processing, database management and spreadsheet applications.

The following courses expose students to Pathway Knowledge and Skills found at http://www.careerclusters.org/goto.cfm?id=73 and should include appropriate student activities.

#4

Product Engineering and Development: Students will learn concepts of product engineering and development using robotics and automated manufacturing techniques and process systems. Concepts of three-dimensional designs and the use of modeling software integrate with lean and agile applications. The focus is on teams who work together as concurrent development organizations where life cycle of the product is analyzed and all concepts of the product are applied.

#5

Digital Electronics: This course teaches students the application of electronic circuits and devices. Students will use their knowledge of both computer simulation and breadboards to design, build and test their own circuits. Students become skilled at using a mathematical logic approach to simplify complex circuits.

#6

Civil Engineering and Architecture: Students will learn about various aspects of civil engineering and architecture through a long-term project that involves the development of a local property site modeling the real-world experiences of practicing civil engineers and architects. The course of study includes the roles of civil engineers and architects, project and site planning, building design, and project documentation and presentation.

#7

Engineering Innovation: Students will utilize ethical and professional practices to work in teams to apply a research and problem-solving model to solve problems of their own choosing. Students will apply engineering principles and be guided by a community mentor. Students will brainstorm possibilities, research current patents and regulations, construct a working model, test the model, document their designs, and present and defend the design to a panel of experts.

#8

Engineering Analysis: Students will study the integrated development of linear algebra and statistics emphasizing engineering applications and incorporating computer exercises involving matrix techniques and calculations using available software packages. Students will choose or create models and other appropriate statistical methods to analyze data and help make decisions.

#9

Engineering Design: This course provides an introduction to the techniques for creating solid models of engineering designs. Topics include three-dimensional modeling of parts and assemblies, visualization, orthographic and isometric free-hand sketching, and computer-generated design documentation. Students will examine elements of the design process including the history of innovation and invention and application concepts of design. Students will demonstrate and apply the design process by designing and/or altering a system, product or service.

#10

Engineering Processes: Students will use mathematics, science and technology concepts and processes to solve problems in engineering projects. Students will apply technological concepts and principles, model technical competence in project and system management, and safely use a variety of tools, machines, equipment, materials and various measuring methods and instruments.

Science, Technology, Engineering & Mathematics

Notes