Correlation of

Foundations of Engineering & Technology, **Wright, Strimel, and Grubbs**

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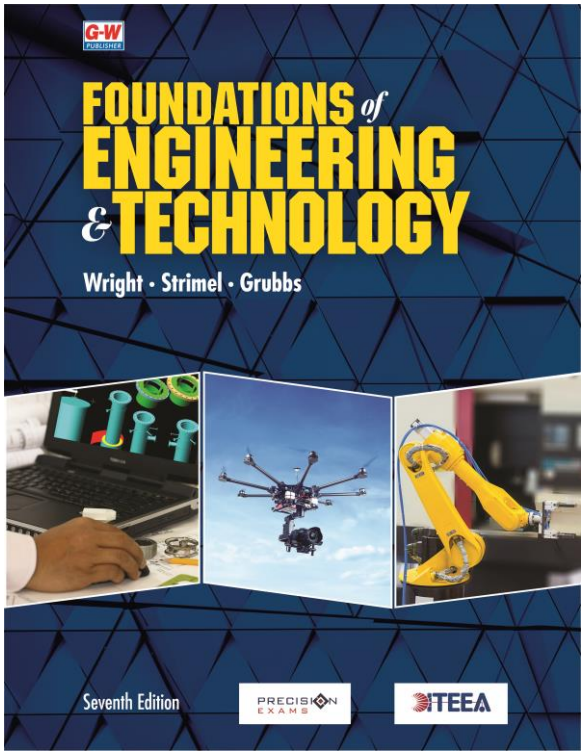
to

Standards for Technological Literacy

The International Technology and Engineering Educators Association (ITEEA) and its Technology for All Americans Project developed *Standards for Technological Literacy: Content for the Study of Technology & Engineering* to identify the essential core of technological knowledge and skills for students in grades K–12. This work defined twenty separate standards, divided into five broad categories. Within each standard, benchmark topics are defined for four different grade levels:

- Grades K–2
- Grades 3–5
- Grades 6–8
- Grades 9–12

The following chart lists the standards and the benchmark topics for grades 9–12. Adjacent to each standard and benchmark topic are page references identifying material in *Foundations of Engineering & Technology* relating to the item.



Standards for Technological Literacy	Textbook Pages
1. Students will develop an understanding of the characteristics and scope of technology.	
The nature and development of technological knowledge and processes are functions of the setting.	13–15, 33–34, 197–209, 234–243, 248, 250–251, 297–299, 399–401, 422–424, 453–454, 515–518, 553–554, 613–614
The rate of technological development and diffusion is increasing rapidly.	6, 170–188, 236–243, 453–454, 553–554
Inventions and innovations are the results of specific, goal-directed research.	28, 50–66, 170-188, 687–689
Most development of technologies these days is driven by the profit motive and the market.	122–124, 160, 193–194, 646–647, 671, 685–686, 699–700
2. Students will develop an understanding of the core concepts of technology.	
Systems thinking applies logic and creativity with appropriate compromises in complex real-life problems.	51, 54–55, 85–89, 95–98, 154, 156

Standards for Technological Literacy	Textbook Pages
Systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems.	54–55, 154–155
The stability of a technological system is influenced by all of the components in the system, especially those in the feedback loop.	156–167, 215–225
Selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste.	55, 73, 288–289
Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development.	50–66, 70–71, 121–124, 193–197
Optimization is an ongoing process or methodology of designing or making a product and is dependent on criteria and constraints.	25, 89
New technologies create new processes.	6–7
Quality control is a planned process to ensure that a product, service, or system meets established criteria.	114–115, 216–218, 290–291, 673, 692–693
Management is the process of planning, organizing, and controlling work.	163–164, 208–209, 211, 672–674, 680, 682–683
Complex systems have many layers of controls and feedback loops to provide information.	165, 215–229
3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	
Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.	25–26, 170–188
Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields.	13, 21–24, 35, 37, 38, 170–188, 234–244
Technological ideas are sometimes protected through the process of patenting.	28, 132
Technological progress promotes the advancement of science and mathematics.	18–31, 41, 83, 110, 125, 155, 163, 183, 209, 220, 271, 282, 286, 300, 308, 329, 337, 359, 384, 409, 440, 497, 505, 524, 588, 622, 673, 698
4. Students will develop an understanding of the cultural, social, economic, and political effects of technology.	
Changes caused by the use of technology can range from gradual to rapid and from subtle to obvious.	518–520, 638–640, 662–664
Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects.	8, 213–215, 288–289, 291–293, 636–647, 662–663, 674–675

Standards for Technological Literacy	Textbook Pages
Ethical considerations are important in the development, selection, and use of technologies.	39–40, 63–64, 71–72, 535, 569, 658
The transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees.	5–6, 286–287, 646–647, 653, 656–664
5. Students will develop an understanding of the effects of technology on the environment.	
Humans can devise technologies to conserve water, soil, and energy through such techniques as reusing, reducing, and recycling.	103, 219, 285, 302, 323, 375, 491, 516, 586, 641–646, 658, 692, 710–711
When new technologies are developed to reduce the use of resources, considerations of trade-offs are important.	73, 289, 643–646
With the aid of technology, various aspects of the environment can be monitored to provide information for decision-making.	219–221, 507–509, 643–646
The alignment of technological processes with natural processes maximizes performance and reduces negative impacts on the environment.	8, 379–381, 710–711
Humans devise technologies to reduce the negative consequences of other technologies.	436, 453, 710–711
Decisions regarding the implementation of technologies involve the weighing of trade-offs between predicted positive and negative effects on the environment.	8, 645–646, 662–663
6. Students will develop an understanding of the role of society in the development and use of technology.	
Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values.	9–13, 152, 213–214, 653–655, 693
The decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures.	150–167, 171–175
A number of different factors, such as advertising, the strength of the economy, the goals of a company, and the latest fads, contribute to shaping the design of and demand for various technologies.	171–175, 187, 403, 475, 519, 646–647, 693–694, 696, 700
7. Students will develop an understanding of the influence of technology on history.	
Most technological development has been evolutionary, the result of a series of refinements to a basic invention.	5–6, 9–13, 171, 400, 553–554, 613–614, 688–689
The evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials.	5–6, 9–13, 19–20, 99–106, 111–114, 158–159, 175–183
Throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape.	5–6, 9–13, 158–159, 638–640, 646–647

Standards for Technological Literacy	Textbook Pages
Early in the history of technology, the development of many tools and machines was based not on scientific knowledge but on technological know-how.	9–11, 24–25, 400, 436–437
The Iron Age was defined by the use of iron and steel as the primary materials for tools.	10, 298
The Middle Ages saw the development of many technological devices that produced long-lasting effects on technology and society.	10–11, 399
The Renaissance, a time of rebirth of the arts and humanities, was also an important development in the history of technology.	11, 516–517
The Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time.	11–12, 34, 250, 393, 436–437, 484, 503, 517–518, 654
The Information Age places emphasis on the processing and exchange of information.	12–13, 27, 654–655
8. Students will develop an understanding of the attributes of design.	
The design process includes defining a problem, brainstorming, researching and generating ideas, identifying criteria and specifying constraints, exploring possibilities, selecting an approach, developing a design proposal, making a model or prototype, testing and evaluating the design using specifications, refining the design, creating or making it, and communicating processes and results.	50–67, 68–92, 94–116, 120–129, 130–147, 194–197
Design problems are seldom presented in a clearly defined form.	58, 69–71, 195
The design needs to be continually checked and critiqued, and the ideas of the design must be redefined and improved.	75, 121, 126–127, 165, 196–197, 215–224
Requirements of a design, such as criteria, constraints, and efficiency, sometimes compete with each other.	70, 121–124
9. Students will develop an understanding of engineering design.	
Established design principles are used to evaluate existing designs, to collect data, and to guide the design process.	38, 56–64
Engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.	37–39
A prototype is a working model used to test a design concept by making actual observations and necessary adjustments.	98, 196, 572
The process of engineering design takes into account a number of factors.	38–42, 70–71, 121–124, 126–127

Standards for Technological Literacy	Textbook Pages
10. Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	
Research and development is a specific problem-solving approach that is used intensively in business and industry to prepare devices and systems for the marketplace.	138, 638–639, 686–690
Technological problems must be researched before they can be solved.	58–59, 71–73, 194–195, 544–545, 550–551
Not all problems are technological, and not every problem can be solved using technology.	51–53
Many technological problems require a multidisciplinary approach.	25–26, 197–209, 234–243, 553–554
11. Students will develop abilities to apply the design process.	
Identify the design problem to solve and decide whether or not to address it.	58, 69–71, 194–195
Identify criteria and constraints and determine how these will affect the design process.	70–71, 93, 195–196, 554
Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of the final product.	85–89, 96–99, 106–107, 114–115, 196, 572
Evaluate the design solution using conceptual, physical, and mathematical models at various intervals of the design process in order to check for proper design and to note areas where improvements are needed.	95–115, 121–122
Develop and produce a product or system using a design process.	92, 93, 274–275, 572
Evaluate final solutions and communicate observation, processes, and results of the entire design process, using verbal, graphic, quantitative, virtual, and written means, in addition to three-dimensional models.	126–127, 131–144
12. Students will develop the abilities to use and maintain technological products and systems	
Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.	93, 130–144, 448
Diagnose a system that is malfunctioning and use tools, materials, machines, and knowledge to repair it.	175–180, 710
Troubleshoot, analyze, and maintain systems to ensure safe and proper function and precision.	709–710
Operate systems so that they function in the way they were designed.	122, 228–229, 274–275, 276
Use computers and calculators to access, retrieve, organize, process, maintain, interpret, and evaluate data and information in order to communicate.	93, 480–481, 550–551, 610–611

Standards for Technological Literacy	Textbook Pages
13. Students will develop the abilities to assess the impact of products and systems.	
Collect information and evaluate its quality.	58–59, 551, 610–611, 658
Synthesize data, analyze trends, and draw conclusions regarding the effect of technology on the individual, society, and the environment.	610–611, 711–713
Use assessment techniques, such as trend analysis and experimentation, to make decisions about the future development of technology.	638–640, 713
Design forecasting techniques to evaluate the results of altering natural systems.	153, 640–646, 649, 650
14. Students will develop an understanding of and be able to select and use medical technologies.	
Medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained.	205, 537–546, 548, 550–551
Telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology.	422, 546, 549
The sciences of biochemistry and molecular biology have made it possible to manipulate the genetic information found in living creatures.	568, 571, 588, 591–592, 614, 629, 631
15. Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.	
Agriculture includes a combination of businesses that use a wide array of products and systems to produce, process, and distribute food, fiber, fuel, chemical, and other useful products.	197–198, 575–611
Biotechnology has applications in such areas as agriculture, pharmaceuticals, food and beverages, medicine, energy, the environment, and genetic engineering.	537–546, 550–551, 553–571, 590–593, 614
Conservation is the process of controlling soil erosion, reducing sediment in waterways, conserving water, and improving water quality.	640–646
The engineering design and management of agricultural systems require knowledge of artificial ecosystems and the effects of technological development on flora and fauna.	635

Standards for Technological Literacy	Textbook Pages
16. Students will develop an understanding of and be able to select and use energy and power technologies.	
Energy cannot be created nor destroyed; however, it can be converted from one form to another.	13, 203, 375–393
Energy can be grouped into major forms: thermal, radiant, electrical, mechanical, chemical, nuclear, and others.	178, 185, 370–373
It is impossible to build an engine to perform work that does not exhaust thermal energy to the surroundings.	384–387, 389–390
Energy resources can be renewable or nonrenewable.	185, 373, 642
Power systems must have a source of energy, a process, and loads.	202–203, 460, 492–493
17. Students will develop an understanding of and be able to select and use information and communication technologies.	
Information and communication technologies include the inputs, processes, and outputs associated with sending and receiving information.	198–200, 239, 241, 421–445
Information and communication systems allow information to be transferred from human to human, human to machine, machine to human, and machine to machine.	428–429, 477
Information and communication systems can be used to inform, persuade, entertain, control, manage, and educate.	239, 241, 428
Communication systems are made up of source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.	199–200, 426–428
There are many ways to communicate information, such as graphic and electronic means.	199, 430–445, 541
Technological knowledge and processes are communicated using symbols, measurement, conventions, icons, graphic images, and languages that incorporate a variety of visual, auditory, and tactile stimuli.	199, 431–479
18. Students will develop an understanding of and be able to select and use transportation technologies.	
Transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety, and agriculture.	205–208, 333–335, 422, 484–485, 585
Intermodalism is the use of different modes of transportation, such as highways, railways, and waterways, as part of an interconnected system that can move people and goods easily from one mode to another.	333–335, 484–485, 488, 513
Transportation services and methods have led to a population that is regularly on the move.	482–513

Standards for Technological Literacy	Textbook Pages
The design of intelligent and nonintelligent transportation systems depends on many processes and innovative techniques.	484–490, 508–511
19. Students will develop an understanding of and be able to select and use manufacturing technologies.	
Servicing keeps products in good operating condition.	709–710
Materials have different qualities and may be classified as natural, synthetic, or mixed.	305–308, 311
Durable goods are designed to operate for a long period of time, while non-durable goods are designed to operate for a short period of time.	288
Manufacturing systems may be classified into types, such as customized production, batch production, and continuous production.	283–284
The interchangeability of parts increases the effectiveness of manufacturing processes.	11–12, 248
Chemical technologies provide a means for humans to alter or modify materials and to produce chemical products.	260–265, 612–632
Marketing involves establishing a product's identity, conducting research on its potential, advertising it, distributing it, and selling it.	425, 687, 693–694, 696
20. Students will develop an understanding of and be able to select and use construction technologies.	
Infrastructure is the underlying base or basic framework of a system.	344, 346
Structures are constructed using a variety of processes and procedures.	200–202, 236–237
The design of structures includes a number of requirements.	200–202, 319–339, 348–361
Structures require maintenance, alteration, or renovation periodically to improve them or to alter their intended use.	202, 339
Structures can include prefabricated materials.	319