| **Required Course Numbers** |
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| **Test Content Categories** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. **Fundamentals of Technology and Engineering**
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| 1. **Core Concepts and Characteristics**
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| 1. Knows technological and engineering systems as interrelated components (e.g., inputs, processes, outputs, and feedback) that are designed collectively to achieve desired goals
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| 1. Knows technology and engineering resources (or inputs), including tools and machines, materials, capital, knowledge, energy, time, and people
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| 1. Understands the development of criteria, constraints, and opportunities during the design process and how these factors affect solutions
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| 1. Understands trade-offs encompass a choice or exchange of one quality over another and how such choices are evaluated with respect to their economic, social, political, environmental, and ethical impacts
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| 1. Understands optimization as an iterative process or methodology of designing or making a product, process, or system that is functional, efficient, safe, and effective
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| 1. Knows controls as the mechanisms or activities that apply information to cause systems to behave in desired ways, and knows how controls are implemented within design
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| 1. **Integration of Knowledge and Practices**
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| 1. Understands and can apply interdisciplinary knowledge (e.g., from STEM and the arts and humanities) to develop technological products that serve a broad range of needs
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| 1. Knows the economic, environmental, and social impacts of technological and engineering systems
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| 1. Understands how advancements in knowledge, technologies, and practices may impact or enhance the iterative process of innovation
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| 1. **Influences, Impacts, and History of Technology**
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| 1. Understands the influence of culture and society on technological and engineering products/systems as well as the influence of interdisciplinary knowledge on technological development
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| 1. Understands the difference between invention and innovation and how significant inventions and innovations were influenced by their historical contexts
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| 1. Knows the impact of technology and engineering on social institutions (e.g., the family, community interaction) and the influence of technological innovation on human history and contemporary society
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| 1. Knows the outcomes and effects (e.g., intended/unintended, desirable/undesirable) of technological products/systems on individuals, society, and the environment
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| 1. Knows the development, analysis, and evaluation of sustainable technological solutions and how to minimize negative impacts on the environment
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| 1. **Design and Application of Products and Systems**
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| 1. **Design in Technology and Engineering**
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| 1. Understands design—and its core elements and principles—as a fundamental human activity
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| 1. Understands the development, implementation, and documentation of iterative design processes and the analysis/evaluation of specific design requirements (i.e., criteria and constraints)
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| 1. Understands the development of analytical solutions to design problems through modeling, evaluation, and optimization of complex designs
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| 1. **Applying, Maintaining, and Assessing Products and Systems**
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| 1. Understands the influence of dependent and related components within larger systems
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| 1. Understands the use of appropriate tools, materials, and machines to maintain, troubleshoot, and repair technological and engineering products/systems
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| 1. Understands the interpretation of data to accurately measure performance of technological and engineering products/systems
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| 1. Understands effective communication of technological information to improve products, systems, and their outcomes
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| 1. **Technology Contexts 1: Energy, Materials, and the Built Environment**
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| 1. **Energy and Power**
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| 1. Knows fundamental concepts and interrelationships of energy, work, and power and the application of these concepts to solve problems (e.g., those involving harness, transfer, circuitry, loss, transmission, and conversion)
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| 1. Knows societal and environmental impacts of the trade-offs involved in energy and power technologies and engineering systems
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| 1. **Materials, Manufacturing, and the Built Environment**
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| 1. Knows the appropriate use of tools, machines, and material processes that lead to technological progress for physical goods within the built environment
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| 1. Knows materials processing, production, and the methods/sequences involved to convert raw materials into industrial materials and industrial materials into finished products
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| 1. Knows fundamental concepts, processes, and properties of materials for construction and manufacturing of physical goods and structures
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| 1. Knows structural systems and subsystems in the context of the built environment, including considerations of functionality, efficiency, safety, and sustainability
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| 1. Is familiar with the characteristics and interrelationships of transportation modes, systems and subsystems, and logistical systems and operations
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| 1. **Technology Contexts 2: Information, Computation, and Technological Applications**
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| 1. **Information and Communications**
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| 1. Knows fundamental concepts and terminology related to information and communications systems (i.e., audio, video, electronic, data, technical, and graphic) and the issues/trends informing their design and use
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| 1. Knows the influence of information and communications technologies on both physical and digital design as well as appropriate ways to address relevant problems and tasks by combining them
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| 1. Understands applications of digital communications and the practical implications of digital citizenship, including associated legal/ethical issues
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| 1. **Computation, Automation, Robotics, and Evolving Technologies**
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| 1. Knows principles of computational thinking (i.e., decomposition, pattern recognition, abstraction, and algorithm design) that help solve technological and engineering problems
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| 1. Knows automation principles and concepts and their application to technological and engineering systems
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| 1. Knows robotic concepts that support the modeling of physical, mechanical, technical, and programmable systems
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| 1. Is familiar with artificial intelligence (AI) technologies, their applications, and associated ethical implications
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| 1. **Pedagogy and Professional Responsibilities**
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| 1. **Pedagogical Foundations**
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| 1. Understands how to select and adapt appropriate materials and activities as well as plan instruction to promote technological and engineering literacy
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| 1. Understands how to provide students with learning experiences that expand their knowledge and skills in technology and engineering
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| 1. Understands project- and problem-based learning methodologies that employ making and doing to support critical thinking, problem solving, creativity, collaboration, and ethics in technology and engineering education
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| 1. Understands how to select, create, and modify appropriate assessments to inform instruction and evaluate student learning in technology and engineering
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| 1. Understands how to differentiate instruction that effectively addresses a variety of student needs
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| 1. Understands how to create a nurturing and supportive learning environment using knowledge of social and emotional principles, student behavior, organizational skills, and classroom management
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| 1. **Principles of Technology and Engineering Education**
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| 1. Understands collaborative relationships of technology and engineering education to other academic subject areas
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| 1. Understands principles and practices that ensure the safety of students in technology and engineering classrooms and laboratories
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| 1. Knows how to access resources and apply strategies to help engage students with technological and engineering content outside the classroom and within the greater community and society
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| 1. Knows how to support professional growth in students by promoting technology student organizations (e.g., Technology Student Association) and encouraging career exploration
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| 1. Knows professional contexts (e.g., organizational, advisory, governmental) and relevant platforms to promote technology and engineering programs beyond the classroom
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| 1. Knows strategies for professional development, lifelong learning, and maintaining and improving technical and pedagogical skills used in technology and engineering education
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| 1. Is familiar with the benefits, offerings, and resources (e.g., professional networking) of professional organizations for technology and engineering educators (e.g., ITEEA, ACTE, ASEE)
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