| **Required Course Numbers** | | | | | | | | | | | | | | | |
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| **Test Content Categories** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **I. The Nature and Practices of the STEM Disciplines** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Interrelationships Among the STEM Disciplines and Their Practices** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands the nature of individual STEM disciplines and their interdependence |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies, describes, and compares the goals and objectives of the individual STEM disciplines |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies the nature and different aspects of a given question or problem (e.g., scientific, engineering, computational) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies and describes how the STEM disciplines are used in combination in the development of solutions to problems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Knows how to apply the practices of the STEM disciplines |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Asks, identifies, defines, and makes sense of questions and problems (e.g., identifies criteria and constraints [such as material, time, space, and cost] in engineering problems) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Evaluates a variety of resources to inform a solution |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies and evaluates one or more potential answers to a question or one or more potential solutions to a problem |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies and describes the use of tools appropriate for measurement, data collection, representation and analysis of data, and problem-solving |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to collect data and uses mathematical reasoning and computational thinking when evaluating potential solutions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies viable arguments and critiques the reasoning of others regarding a proposed plan with viable justifications |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Describes how to plan investigations (e.g., experiments, observational investigations) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies and uses models (e.g., conceptual, physical, mathematical, and computational) for representation, simulation, and testing and recognizes the limitations of models |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Evaluates explanations and design solutions (e.g., explanations, prototypes, algorithms, equations) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Appropriately collects, analyzes, and interprets data (qualitative, quantitative) and patterns in data |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Evaluates, compares, and improves solutions to meet the criteria and constraints (e.g., identifies and evaluates strengths and weaknesses of proposed solutions, recognizes that there may be no perfect solution) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Represents and communicates solutions and ideas with supporting evidence and appropriate STEM vocabulary |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. STEM and Society** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands impacts of technology on society |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways that technology helps with everyday tasks (e.g., at home, in the community, in the larger world) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies examples of helpful and harmful effects of technology |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies examples of how certain aspects of people’s daily lives would be different without given technologies |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies and describes the impact that a solution has on a user and/or on the community |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands relationships between changes in technology and changes in society |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies connections between technology and human experiences and identifies examples of how technology has influenced the way people live and work throughout history |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways in which the natural world can contribute to the human-made world to foster innovation |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies examples of how technologies are developed or adapted when individual or societal needs and wants change |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **II. Computer Science for STEM** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Data, Algorithms, and Programming** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands collection, presentation, analysis, and interpretation of data |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Selects software and applications that collect data and identifies how to present collected data in various formats using technology |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies and describes patterns and makes predictions using data visualizations (e.g., charts, graphs) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Uses data to highlight or propose cause-and-effect relationships, predict outcomes and correlation, or communicate an idea using digital systems |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands algorithms and other programming concepts |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Models everyday processes by identifying, creating, and following sets of step-by-step instructions (algorithms) and compares and refines multiple algorithms for the same task |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Selects and uses programs that include control structures (e.g., sequences, events, loops, and conditionals) to express ideas or address a problem |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Demonstrates how breaking down a problem into steps or smaller manageable subproblems can help in creating a precise sequence of instructions to solve the problem |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Modifies, remixes, or incorporates portions of an existing program to develop something new or add more advanced features |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Interprets plans that describe a program’s sequence of events, goals, and expected outcomes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies and fixes (debugs) errors in an algorithm or program that includes sequences, simple loops, and simple branching to ensure that it runs as intended |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Demonstrates how to take on varying roles when collaborating during the design, implementation, and review stages of program development |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Communicates, using discipline/content-specific terminology, steps taken and choices made during the iterative process of program development, using code comments, presentations, and demonstrations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Computing Technology and Society** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands computing devices and their components, the relationship between hardware and software, and basic techniques of troubleshooting |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Selects and identifies how to operate appropriate software to perform a task |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies and describes, using appropriate terminology, the function of common hardware and how hardware and software work together as a system to accomplish tasks |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Describes, using accurate terminology, and demonstrates how to troubleshoot simple hardware and software problems (e.g., screen is frozen, log-in issues) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands fundamental concepts related to protecting digital information on the Internet |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Describes what passwords are, why we use them, and why strong passwords are used to protect devices and information |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Describes how to protect personal and digital information on the Internet and why it is important to do so |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands positive and negative impacts of computing technology |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Describes the impact computer science has had on other STEM disciplines, as well as various career fields in and out of the technology sector |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands issues of computing technology related to safety, law, and ethics |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to improve the accessibility and usability of technology products for the diverse needs and wants of users |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Demonstrates how to work respectfully and responsibly with others online and describes the role of seeking out diverse perspectives in improving computational artifacts (e.g., programs, Web pages) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Recognizes intellectual property rights when using the ideas and creations of others and gives appropriate attribution when creating, remixing, or adapting programs |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Describes public domain and Creative Commons media and the issues that arise from copying or using material created by others without permission |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Describes how to keep log-in information private and the importance of logging out of devices appropriately |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **III. STEM Pedagogy** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **A. Students and Learning** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Knows how to create opportunities for successful learning experiences and outcomes for each and every student |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to organize and deliver STEM instruction using research-based strategies that are developmentally appropriate and responsive to individual students, building on cultural and linguistic differences |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Uses instructional formats (e.g., whole group, small group, partner, individual) skillfully and flexibly in support of STEM learning goals and in consideration of various settings |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to encourage the development of soft skills such as critical thinking, communication, collaboration, and creativity in the STEM classroom |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to facilitate students’ engagement in productive struggle in STEM education (e.g., the importance of learning from failure, perseverance, adaptability, cooperation, organization, responsibility) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Knows how to facilitate equitable access to high-quality instruction for each and every student |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to draw on students’ strengths to create inclusive social-learning contexts that engage and build collaboration skills among students in discussions, explorations, and investigations in order to motivate and extend STEM learning opportunities that connect to students’ lived experiences |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to support the equitable learning of STEM content by embracing and purposefully incorporating diversities of the classroom and school—cultural, racial, ethnic, ability, linguistic, gender, socioeconomic, developmental, and so forth—and uses this knowledge to motivate and extend learning opportunities in STEM education |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to cultivate positive diverse identities and promote positive dispositions toward all the STEM disciplines, including computer science learning |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies examples of the roles of power, privilege, and oppression in the history of STEM education and evaluates existing and proposed educational systems that produce inequitable learning experiences and outcomes for students |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to advocate for the rights and needs of students to secure resources and promote academic advancement in STEM education |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Demonstrates knowledge of educational structures and policies that affect equitable access to quality STEM instruction |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **B. Curriculum, Assessment, and Professional Development** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands equitable curriculum and assessment practices in the STEM classroom |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Recognizes characteristics of engineering design and identifies design challenges that require students to use the engineering design process |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to adapt and implement a research-based STEM curriculum |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to design and implement STEM instruction that allow students to emphasize problem solving and to develop STEM literacy |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to use appropriate instructional technology equipment, materials, processes, and tools to enhance STEM teaching and to actively engage students in learning |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Selects and uses a variety of assessment methods—formal and informal, formative and summative—to monitor and evaluate both student STEM learning and instructional effectiveness |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Selects authentic STEM instruction that helps students make connections between STEM and other content areas, careers, and everyday life |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Understands how to grow professionally as a STEM teacher |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to promote STEM education internally and externally (e.g., to the community, school staff, and students) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to collaborate with other school staff to design, implement, evaluate, and improve instruction that integrates knowledge and skills from other core academic subject areas into STEM instruction |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to use self-reflection to keep STEM teaching relevant to students and to remain innovative and up-to-date with new practices, technology, and strategies |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1. Identifies ways to use professional development (e.g., formal instruction, in-service activities, professional-association meetings) to facilitate personal professional growth |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |