CAPS Technology and Software Engineering

UNIT 1: Software Engineering and Programming Fundamentals

ESSENTIAL QUESTION	BIG IDEAS
How do software engineering principles and programming fundamentals contribute to the development of technology solutions?	• Understanding Software Development Lifecycle and Methodologies • Mastering Programming Languages and Data Structures • Applying Design Patterns and Best Practices in Software Engineering • Understanding and utilizing math principles specific to programming.

GUIDING QUESTIONS

Content

- What are the key stages of the software development lifecycle, and how do different methodologies, such as Agile and Waterfall, influence project management and execution?
- How do programming languages and data structures enable developers to create efficient and scalable software solutions?
- What design patterns, coding standards, and testing strategies are essential for maintaining code quality and facilitating collaborative development?
- What are specific math principles that can aid in the structure and function of programing architecture?

Process

- How can students apply software engineering principles to analyze, design, implement, and test software systems that meet client requirements?
- What strategies and tools can students use to debug, troubleshoot, and refactor code to improve its performance and maintainability?
- In what ways can students collaborate effectively in teams to develop and deliver software projects on time?
- How can students use math principles to support code development?

Reflective

- How has your understanding of software development methodologies and programming concepts evolved throughout this unit?

FOCUS STANDARDS

Foundations of Information Technology Course No. 10001

BENCHMARK 2: WORKING KNOWLEDGE OF BASIC COMPUTER COMPONENTS AND THE DIGITAL THEORY BEHIND THEIR OPERATION.

Competencies

#	DESCRIPTION
2.3	Distinguish between the binary and hexadecimal counting systems. Using appropriate units, provide examples of each system and identify specific instances when IT professionals rely on them.
2.4	Explain the functions of gates in logic circuits (e.g., AND, OR, NOT).

BENCHMARK 3: CAREER AWARENESS IN INFORMATION TECHNOLOGY

Competencies

#	DESCRIPTION
3.1	Research various occupations in information technology industries, such as programmers, web designers, webmasters, networking administrators, computer systems administrators, telecommunications line installers, and informational security analysts.
3.2	Explore various professional societies related to information technology and identify the services and benefits provided by each member.

BENCHMARK 4: UNDERSTANDING OF THE HISTORY BEHIND THE INTERNET AND OPERATING SYSTEMS.

Competencies

#	DESCRIPTION
4.1	Drawing on multiple sources, research the history of the Internet. Discuss both the benefits and disadvantages of the Internet to society, as well as potential implications for the future.
4.2	Drawing on multiple sources (i.e., internet, textbooks, videos, and journals), research the history and development of operating systems (e.g., Microsoft Windows, Linux, UNIX).

BENCHMARK 5: WORKING KNOWLEDGE OF INFORMATION TECHNOLOGY TERMINOLOGY AND RELATED CONCEPTS.

Competencies

#	DESCRIPTION
5.1	Demonstrate an understanding of basic web terminology and concepts. Practice explaining these terminologies and concepts by creating methods to help students learn and remember the information.

5.2	Demonstrate a basic understanding of computer hardware components. Identify these components using pictures or actual models and briefly explain the function of each. Components should include, but are not limited to: a. Hardware used for input and output, b. Hardware inside the computer case, c. Motherboard, d. Processor and the chipset, e. Storage devices (e.g., primary, secondary), f. Expansion cards, and g. Electrical system.
5.3	Demonstrate a basic understanding of computer networking. For example, explain the types of networks and what a client-server environment is.

BENCHMARK 6: UNDERSTAND THE IMPORTANCE OF PROPER ORGANIZATION OF MATERIALS IN INFORMATION TECHNOLOGY.

Competencies

#	DESCRIPTION
6.1	Understand and demonstrate the effective use of file and folder management techniques to maintain directory structure for a web site. Describe the most efficient methods for digital file management, including the use of site root and subfolders for assets (e.g., images, templates, CSS).

BENCHMARK 7: WORKING KNOWLEDGE OF PROGRAMMING LANGUAGES, THEIR DEVELOPMENT, AND VARIOUS IMPLEMENTATIONS

Competencies

#	DESCRIPTION
7.1	Explore and identify various languages, such as Python, HTML, PHP, C++, Visual Basic, Java, JavaScript, and C #. Explain how programmers use these languages to solve a variety of IT problems, furnishing examples of how they are applied.
7.2	Using various resources, research, identify, and explain the steps involved in the software development life cycle, including but not limited to: planning, designing, coding, testing, deployment, and maintenance. Explain why it is an iterative process and always involves refinement.
7.3	Demonstrate an understanding of how batch files function within a programming environment. Identify common commands to create code for batch files (e.g. title, echo, echo off, pause, CLS, ipconfig, and ping).

JCCC CS 210

I. Propositional and Predicate Logic

A. Explain with examples the basic terminology of propositions, predicates and quantifiers.

B. Perform the operations associated with propositions, predicates and quantifiers.

C. Compare practical examples to the appropriate propositional or predicate logic model and interpret the associated operations and terminology in context.

D. Convert logical statements from informal language to propositional and predicate logic expressions.

E. Apply formal logic proofs and/or informal, but rigorous, logical reasoning to real problem, such as predicting the behavior of software or solving problems, such as puzzles.

F. Use the rules of inference to construct proofs in propositional and predicate logic.

G. Describe how symbolic logic can be used to model real-life situations or computer applications.

H Apply formal methods of symbolic propositional and predicate logic, such as calculating validity of formulae and computing normal forms.

II. Proof Techniques

A. Outline the basic structure of each proof technique: direct proof, contrapositive proof, proof by contradiction, proof by cases and proof by exhaustion.

B. Construct a correct logical argument for each of the proof techniques.

C. Construct an inductive proof of a mathematical statement.

D. Deduce the best type of proof for a given problem.

III. Set Theory

A. Explain with examples the basic terminology of sets.

B. Perform the operations associated with sets.

C. Compare practical examples to the appropriate set model and interpret the associated operations and terminology in context.

D. Describe the common mathematical sets.

E. Express sets using the roster notation, the set builder notation and Venn diagrams.

F. Construct the power set of a given set.

G. Calculate the cardinality of a given set.

H. Calculate set equalities with the use of set identities.

I. Calculate the Cartesian product of sets.

J. Calculate partitions of a given set.

IV. Functions

A. Explain with examples the basic terminology of functions.

B. Perform the operations associated with sets, functions and relations.

C. Compare practical examples to the appropriate function model and interpret the associated operations and terminology in context.

D. Calculate values using the floor and ceiling functions.

E. Determine if a function is one-to-one.

F. Determine if a function is onto.

G. Calculate the inverse of a bijective function.

H. Calculate the composition of two functions.

I. Calculate values using the log and exponential functions using properties of the two functions.

V. Boolean Algebra

A. Compare the elements and the operations of propositional logic and set theory to those of Boolean Algebra.

B. Define Boolean functions.

C. Convert Boolean expressions to disjunctive normal form and conjunctive normal form.

D. Determine if a set of operators is functionally complete.

E. Design a digital circuit using AND gates, OR gates and inverters to implement a Boolean expression.

VI. Relations

A. Construct an arrow diagram of a relation.

B. Construct an adjacency matrix representation of a relation.

C. Calculate trails, paths, circuits and cycles in a directed graph.

D. Calculate the composition of relations.

E. Construct a Hasse Diagram of a partial order.

F. Construct a partition of an equivalence relation.

G. Determine the transitive closure of a relation using matrices.

KEY LEARNING EXPERIENCES

- Fundamental Discrete Math College Credit
- Hands-on Coding Sessions In Various Programming Languages
- Problem-solving Activities:
- Code Reviews and Debugging Exercises:
- Mini-Projects:
- Algorithm Design and Analysis:
- Documentation and Best Practices:

CAPS Technology and Software Engineering

UNIT 2: Emerging Technologies

ESSENTIAL QUESTION	BIG IDEAS
How do emerging technologies shape the future of technology solutions and software engineering?	• Exploring Cutting-Edge Technologies and Innovations • Understanding the Impact of Emerging Technologies on Business and Society • Evaluating Risks and Opportunities of Adopting New Technologies

GUIDING QUESTIONS

Content

- What are the latest trends and advancements in emerging technologies, such as artificial intelligence, cybersecurity, blockchain, Internet of Things (IoT), and augmented reality?
- How do emerging technologies disrupt traditional industries and create new opportunities for innovation and growth?
- What ethical, legal, and security considerations arise from the adoption and implementation of emerging technologies in various domains?

Process

- How can students research and analyze emerging technologies to assess their potential applications and implications for different industries?
- What strategies can students use to prototype and experiment with new technologies to demonstrate proof of concepts and feasibility?
- In what ways can students collaborate with industry partners and stakeholders to identify and address challenges in adopting and integrating emerging technologies?

Reflective

- How has your perspective on emerging technologies evolved throughout this unit, and what implications do they have for your future career in technology?
- What ethical dilemmas or considerations have you encountered in exploring the potential applications of emerging technologies?

FOCUS STANDARDS

Emerging Technologies Course No. 21053

#	DESCRIPTION
1.1	Demonstrate the research skills necessary to identify and evaluate emerging technologies
1.2	Seek and identify sources of information on new technology.
1.3	Identify solutions and problems that go beyond the expected and obvious.
1.4	Identify sciences and technology areas most impacted and with most potential to utilize the new technologies.
1.5	Be able to explain why it is important for STEM professionals to keep abreast of evolving technologies.
1.6	Be able to discuss the advantages, disadvantages, and prospects of current emerging technologies.
1.7	Discuss in depth a chosen emerging technology, based on independent research.
1.8	Explain the change process.
1.9	Develop a plan for anticipating change.
1.10	Address each of the following areas to varying degrees based on available information: 1. anticipated employment 2. drivers and constraints 3. size and location of market 4. connection(s) to existing technologies 5. ability and ease of replication

6. physical and capital costs
7. industry and education partnerships to be leveraged
8. national best practices
9. illustrate qualifications, recommendations, aims and approaches for the Technological innovation
10. Innovation system modeling
11. Technology monitoring forecasting and assessment
12. Trend analysis methods & scenarios
13. Impact assessment
14. Risk analysis
15. Action (policy) analysis
16. Technology road mapping
17. Communication and implementation of innovation forecasts.

KEY LEARNING EXPERIENCES

- Research projects and presentations on emerging technologies and their impact on specific industries or societal challenges.
- Technology showcases and demonstrations featuring prototypes or pilot projects developed by students.
- Debates and discussions on the ethical, social, and economic implications of emerging technologies.
- Guest lectures or panel discussions with industry experts and thought leaders in emerging technology domains.
- Hands-on labs and workshops exploring practical applications of emerging technologies, such as IoT devices or machine learning models.
- Multimedia presentations on personal insights and lessons learned from exploring and experimenting with emerging technologies.

CAPS Technology and Software Engineering

UNIT 3: Managing Technology Industry Projects

ESSENTIAL QUESTION	BIG IDEAS
How do effective project management practices ensure successful delivery of technology solutions and software engineering projects?	• Mastering Project Management Methodologies and Tools • Navigating Stakeholder Engagement and Communication • Balancing Scope, Time, Cost, and Quality in Project Execution

GUIDING QUESTIONS

Content

- What are the fundamental principles and frameworks of project management, and how do they apply to technology industry projects?
- How do project managers identify, prioritize, and manage stakeholder expectations and requirements throughout the project lifecycle?
- What strategies and techniques can project managers use to mitigate risks, resolve conflicts, and ensure project success within constraints?

Process

- How can students apply project management methodologies, such as Agile, to plan, execute, and monitor technology projects effectively?
- What communication strategies and tools can students utilize to facilitate collaboration and alignment among project teams and stakeholders?
- In what ways can students employ project management software and metrics to track progress, measure performance, and make data-driven decisions?

Reflective

- How have your project management skills and competencies developed throughout this unit, and how do they align with industry standards and best practices?
- What lessons have you learned about the importance of adaptability and resilience in managing technology projects in dynamic and complex environments?

FOCUS STANDARDS

Project Management Course No. 41350

BENCHMARK 1: PATHWAY PROJECT VISION

Competencies

#	DESCRIPTION
1.1	Clearly identify what is desired to be created.
1.2	Create a multi-step project (should be multi-student) by defining the opportunity statement.
1.3	List what is to be the end result of the project; what it is that will be created. (This is not what needs to be done to complete the project or how it is to be done).
1.4	list the impact of this project; why it is important and worthwhile to create

BENCHMARK 2: PROJECT INITIATION

Competencies

#	DESCRIPTION
2.1	Initiate the project by identifying the resources and the details needed for the project: the project deliverables, project budget, project sponsor, project manager, scope, due date and project team members and, if desired, their roles.
2.2	Document project initiation phase in a project Charter or Project Initiation Document (PID).

BENCHMARK 3: PROJECT PLANNING

Competencies

#	DESCRIPTION
3.1	project team should collectively plan the steps to complete the project deliverables within the budget and due date.
3.2	outline the scheduling and utilization of project resources.
3.3	Develop KanBan or Notion chart for the project complete with schedule, tasks, resource assignments and graphical timeline.

BENCHMARK 4: PROJECT EXECUTION

Competencies

#	DESCRIPTION
4.1	Proceed with accomplishment of project deliverables.
4.2	utilize methods such as team progress meetings and/or formal status updates to

report adherence to the project plan.

BENCHMARK 5: PROJECT CONTROL

Competencies

#	DESCRIPTION
5.1	Check, verify and document adherence to quality standards as defined in the project deliverable specifications.

BENCHMARK 6: PROJECT CLOSURE

Competencies

#	DESCRIPTION
6.1	Prepare a team Closure Report that reconciles budgetary results, provides an overview of the project, and analyzes the effectiveness of the project management and resource scheduling processes through use of a tool such as a Plus (what went well that we would want to repeat) / Delta (what could have gone better that we would modify next time) Analysis.

BENCHMARK 7: COLLABORATION

Competencies

#	DESCRIPTION
7.1	Demonstrate effective teamwork and interaction through teambased accomplishment of all of the above tasks and elements.
7.2	Practice communication, negotiation and effective teamwork skills in an effort to create a synergistic result.

BENCHMARK 8: ANCILLARY PROJECT MANAGEMENT CONCEPTS

Competencies

#	DESCRIPTION
8.1	Demonstrate understanding of the concepts and their relevance to Project Management:
	1. Stakeholder Management
	2. Critical Path Method
	3. Change Management / Scope Creep
	4. Agile Project Management
	5. Budgetary Considerations
	6. Careers in Project Management.

KEY LEARNING EXPERIENCES

- Project planning exercises, including scope definition, work breakdown structure, and resource allocation.
- Role-playing simulations of project kickoff meetings, stakeholder workshops, and risk management sessions.
- Guest lectures or workshops on project management methodologies and tools, delivered by

certified project management professionals.
- Team-based projects collaborating with industry partners to solve real-world technology challenges and deliver tangible outcomes.
- Case studies and post-mortem analyses of successful and unsuccessful technology projects, focusing on lessons learned and best practices.
- Reflective journals or peer feedback sessions on personal experiences and growth as aspiring technology project managers.

CAPS Technology and Software Engineering

UNIT 4: Professional Skills Development through Career Exploration

ESSENTIAL QUESTION	BIG IDEAS
What are key professional skills needed to prepare future professionals in a career they are exploring?	• Holistic Skill Development: Prioritize a diverse set of skills beyond technical expertise and including an entrepreneurial mindset. • Experiential Learning: Hands-on experiences, internships, apprenticeships, and project-based learning opportunities provide career exploration opportunities. • Mentorship and Networking: Facilitate mentorship programs and networking events to connect young professionals with experienced individuals in their field.

GUIDING QUESTIONS

Content

- What are effective communication strategies and tools used in specific professions?
- Why are critical thinking, problem-solving and adaptability important?
- How can professional skill development bridge the gap between theoretical knowledge and practical application and enhance understanding of future career opportunities?
- How can mentors offer guidance, advice, and valuable insight most effectively?

Process

- How can students learn about their current strengths and opportunities for development?
- How can experiential learning opportunities holistically create opportunities to practice professional skills?

Reflective

- How does professional skill development foster lifelong learning and development?
- How can I take these skills and transfer them to post secondary and future careers?

FOCUS STANDARDS

CTE Professionalism Standards

1.1 Act as a responsible and contributing citizen and employee.
1.2 Apply appropriate academic and technical skills.
1.4 Communicate clearly, effectively and with reason.
1.5 Consider the environmental,social and economic impacts of decisions.
1.6 Demonstrate creativity and innovation.
1.7 Employ valid and reliable research strategies.
1.8 Utilize critical thinking to make sense of problems and persevere in solving them.
1.9 Model integrity, ethical leadership and effective management.
1.10 Plan education and career path aligned to personal goals.
1.11 Use technology to enhance productivity.
1.12 Work productively in teams while using cultural/global competence.

CAPS Professional Profile

Skills: Communication, Collaboration, Time Management, Conflict Resolution, Critical Thinking, Interpersonal Relationship, Creativity, Leadership

Attributes: Adaptability, Curiosity, Self-awareness, Drive, Confidence, Enthusiasm, Resourcefulness, Integrity, Empathy

Actions: Networking, Interviewing, Goal Setting, Professional Manner

KEY LEARNING EXPERIENCES

- Experiential learning opportunities such as project presentations, apprenticeships, client projects and internships.
- Interview opportunities with community members.
- Mentorship events where students are connected to professionals in their chosen careers.
- Development of digital portfolios and resume building that are industry standard and can grow with students.