Maryland CTE Programs of Study

Computer Programming III – Java Capstone (2025)

GENERAL REQUIREMENTS. This course is recommended for students in Grades 11-12. 1

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INTRODUCTION 2

A Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions. 2.A

B The Digital Technology Career Cluster focuses on building linkages in IT occupations for entry level, technical, and professional careers related to the design, development, support, and management of hardware, software, multimedia, and systems integration services. 2.B

C The Computer Programming Program of Study provides high school students with comprehensive software development skills through mastery of Python and Java programming languages. Students' progress from fundamental coding concepts to complex development projects while earning industry certifications and building professional portfolios. Graduates emerge prepared for both college computer science programs and immediate entry into software development careers, equipped with practical experience in current programming practices and software engineering principles. 2.C

D Computer Programming III advances students' programming skills through practical experience in full-stack development, focusing on web and Android applications using frameworks like Flask, Spring Boot, and Android Studio. Students master modern development practices including API design, cloud deployment, and agile methodologies while creating production-ready applications. Through hands-on projects and industry-standard tools, students build a professional portfolio that demonstrates expertise in both web and mobile development. This course prepares students for careers such as full-stack developer, mobile app developer, DevOps engineer, or API specialist, while providing a strong foundation for computer science degrees with a focus on modern application development. 2.D

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E **Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.** 2.E

F **Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.** 2.F

KNOWLEDGE AND SKILLS 3

A **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:** 3.A

1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work. 3.A.1
2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn. 3.A.2
3. Employ effective reading, writing, and technical documentation skills. 3.A.3
4. Solve problems using critical thinking techniques and structured troubleshooting methodologies. 3.A.4
5. Demonstrate leadership skills and collaborate effectively as a team member. 3.A.5
6. Implement safety procedures, including proper handling of hardware and following cybersecurity guidelines. 3.A.6
7. Exhibit an understanding of legal and ethical responsibilities in the IT field, following data privacy laws and best practices for security. 3.A.7
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting. 3.A.8

B **The student identifies various career pathways in the computer programming field. The student is expected to:** 3.B

1. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in computer programming. 3.B.1
2. Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations. 3.B.2
3. Demonstrate effective interview skills for roles in IT and computer programming. 3.B.3

C **The student develops technology and digital literacy skills. The student is expected to:** 3.C

1. Use technology as a tool for research, organization, communication, and problem-solving. 3.C.1
2. Use digital tools, including computers, mobile devices, collaboration platforms, and cloud services, to access, manage, and create information. 3.C.2

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3 Demonstrate proficiency in using emerging and industry-standard technologies, including virtualization tools, network management software, and cybersecurity applications. 3.C.3

4 Understand ethical and legal considerations for technology use, including the principles of data protection, copyright, and responsible technology use. 3.C.4

D The student integrates core academic skills into computer programming practices. The student is expected to: 3.D

1 Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards. 3.D.1

2 Apply mathematical concepts such as Algebraic functions and equations, Boolean algebra and logic, basic statistics for data analysis, order of operations, number systems (binary, decimal), percentages and proportions, basic geometry (for graphics and spatial problems) and pattern recognition. 3.D.2

3 Use scientific principles, such as data collection, pattern recognition, systematic investigation, controlled testing, and documentation of process. 3.D.3

E The student can analyze professional software development practices. The student is expected to: 3.E

1 Evaluate various software development methodologies (Agile, Scrum, Waterfall). 3.E.1

2 Apply version control systems using Git for code management. 3.E.2

3 Implement project planning and tracking tools. 3.E.3

4 Design comprehensive documentation for software projects. 3.E.4

5 Create effective technical specifications and requirements. 3.E.5

6 Assess project risks and develop mitigation strategies. 3.E.6

F The student can create advanced programming solutions. The student is expected to: 3.F

1 Develop complex applications using chosen language (Python/Java). 3.F.1

2 Implement design patterns appropriate to project requirements. 3.F.2

3 Create modular, reusable code components. 3.F.3

4 Design efficient algorithms for complex problems. 3.F.4

5 Build robust error handling and logging systems. 3.F.5

6 Integrate third-party libraries and APIs effectively. 3.F.6

G The student can evaluate software testing methodologies. The student is expected to: 3.G

1 Design comprehensive test plans and test cases. 3.G.1

2 Implement unit testing frameworks. 3.G.2

3 Perform integration testing across system components. 3.G.3

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4 Create automated testing scripts. 3.G.4

5 Apply debugging strategies for complex issues. 3.G.5

6 Document testing procedures and results. 3.G.6

H The student can develop database integration solutions. The student is expected to: 3.H

1 Design database schemas for applications. 3.H.1

2 Implement CRUD operations in applications. 3.H.2

3 Create efficient database queries. 3.H.3

4 Apply database security best practices. 3.H.4

5 Handle data validation and sanitization. 3.H.5

6 Manage database connections effectively. 3.H.6

I The student can synthesize user interface design principles. The student is expected to: 3.I

1 Create intuitive user interfaces. 3.I.1

2 Implement responsive design principles. 3.I.2

3 Apply accessibility standards. 3.I.3

4 Design effective user feedback systems. 3.I.4

5 Develop input validation mechanisms. 3.I.5

6 Create consistent design patterns. 3.I.6

J The student can manage project development cycles. The student is expected to: 3.J

1 Plan project timelines and milestones. 3.J.1

2 Coordinate team member responsibilities. 3.J.2

3 Conduct code reviews and provide feedback. 3.J.3

4 Manage project dependencies. 3.J.4

5 Track and resolve project issues. 3.J.5

6 Present project progress to stakeholders. 3.J.6

K The student can apply security best practices. The student is expected to: 3.K

1 Implement secure coding practices. 3.K.1

2 Create authentication and authorization systems. 3.K.2

3 Protect against common security vulnerabilities. 3.K.3

4 Manage sensitive data appropriately. 3.K.4

5 Perform security testing. 3.K.5

6 Document security measures. 3.K.6

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L The student can create professional portfolios. The student is expected to: 3.L

1. Document project development processes. 3.L.1
2. Create technical presentations. 3.L.2
3. Develop project demonstrations. 3.L.3
4. Write clear project documentation. 3.L.4
5. Present solutions to stakeholders. 3.L.5
6. Maintain professional online presence. 3.L.6