Maryland CTE Programs of Study

Structural Analysis & Advanced Systems (2025)

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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 Supply Chain & Transportation Career Cluster encompasses the transfer, coordination, and management of goods from production to consumption, ensuring efficient movement across various modes of transportation including air, ground, and water, as well as Collision Repair and Refinishing of the respective transport modes. This Cluster integrates logistics and distribution networks to facilitate the seamless flow of materials and products, playing a crucial role in global commerce, economic development, and community health.** 2.B

C **The Automotive Collision and Repair program prepares students for careers in the automotive collision industry through a four-course sequence combining hands-on skills with technical knowledge. Students progress from foundational safety and repair principles through advanced structural analysis and modern vehicle systems. Throughout the program, students master essential skills including metal straightening, welding, refinishing techniques, and structural repairs while gaining experience with industry-standard tools and equipment. Students learn to analyze damage, write estimates, repair panels, apply primers and paints, and work with advanced driver assistance systems (ADAS). The program aligns with ASE Education Foundation Entry-Level certifications: Non-structural Analysis & Damage Repair, Painting & Refinishing, and Structural Analysis & Damage Repair. Additionally, systems who use the I-CAR PDP-EE Curriculum may also earn ICAR Platinum ProLevel 1 credentials. These certifications position students for immediate employment in collision centers, dealerships, or custom shops, or continued education in advanced automotive programs.** 2.C

D **This advanced course prepares students for the ASE Entry-Level Certification in Structural Analysis & Damage Repair while introducing modern vehicle technology concepts. Students learn to perform structural damage analysis,**

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frame measuring, and advanced pulling techniques while gaining experience with ADAS (Advanced Driver Assistance Systems) and their impact on collision repair. The course covers complex structural repairs, mechanical and electrical system diagnosis, and calibration procedures for advanced vehicle systems. Students master integration procedures, advanced welding techniques, and comprehensive documentation requirements. Special emphasis is placed on understanding the relationship between structural integrity and vehicle safety systems, preparing students for the evolving challenges of modern collision repair. 2.D

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, Collision Repair and Refinishing 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, Collision Repair and Refinishing 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 OSHA guidelines. 3.A.6
7. Exhibit an understanding of legal and ethical responsibilities in the Automotive Collision Repair and Refinishing field, following applicable laws and best practices for safety. 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 Automotive Collision Repair and Refinishing field. The student is expected to:** 3.B

1. Develop a career plan that includes the necessary education, certifications, job skills, experience, and progression steps for specific roles as a technician or in the Automotive Collision Repair and Refinishing field. 3.B.1

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2 Create a professional resume and portfolio that reflects skills, projects, certifications, and recommendations. 3.B.2

3 Demonstrate effective interview skills for roles in the Automotive Collision Repair and Refinishing field. 3.B.3

C The student identifies the issues associated with Automotive Collision Repair and Refinishing hazards found on a jobsite. The student is expected to: 3.C

1 Demonstrate safe working procedures in a lab/shop environment. 3.C.1

2 Explain the purpose of the Occupational Safety and Health Administration (OSHA) and how it promotes safety on the job. 3.C.2

3 Identify Automotive Collision Repair and Refinishing related workplace hazards and how to avoid or minimize them. 3.C.3

4 Explain safety issues concerning lockout and tagout procedures, personal protection using assured grounding and isolation programs, automotive lift safety, and other equipment related safety protocols. 3.C.4

D The student integrates core academic skills into Automotive Collision Repair and Refinishing 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 vector analysis for collision forces, three-dimensional geometry for frame measurements, and complex trigonometric calculations for structural alignment. Students apply analytical geometry in frame measurement, vector mathematics in force analysis, and advanced algebraic formulas in steering geometry calculations. Electronic system diagnostics incorporate Ohm's Law calculations, voltage drop analysis, and resistance calculations. Statistical process control methods are employed in quality assurance procedures, while advanced estimating requires compound calculations involving multiple variables. 3.D.2

3 Focus on advanced physics concepts in structural dynamics, electronic theory in vehicle systems, and materials science in modern composites. Students analyze energy management principles in crash dynamics, electronic signal processing in sensor operations, and strain gauge theory in measuring equipment. The course covers advanced concepts in hydraulics and pneumatics, including Pascal's Law, pressure relationships, and fluid dynamics. Electrical theory expands to include semiconductor principles, digital logic operations, and sensor calibration physics. Materials science concepts address high- strength steel metallurgy, composite material behavior, and advanced joining technology principles. 3.D.3

E The student performs structural analysis and repair procedures. The student is expected to: 3.E

1 Utilize frame measuring equipment. [SA-A1-3] 3.E.1

2 Analyze structural damage patterns. [SA-A3-7] 3.E.2

- Create comprehensive repair plans. [SA-B6] 3.E.3
- Execute proper anchoring and pulling techniques. [SA-B7-12] 3.E.4

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5 Evaluate repair quality using measurement data. [SA-B13-15] 3.E.5

F The student demonstrates understanding of advanced vehicle systems. The student is expected to: 3.F

1 Diagnose ADAS system operations. [ME-I1-5] 3.F.1

2 Perform electrical system diagnostics. [ME-B1-5] 3.F.2

3 Analyze mechanical system functions. [ME-C1-5] 3.F.3

4 Execute calibration procedures. [ME-I1-5] 3.F.4

5 Evaluate system operation after repair. [ME-I3-5] 3.F.5

G The student performs complex structural repairs. The student is expected to: 3.G

1 Execute frame repair procedures. [SA-A8-11] 3.G.1

2 Perform unibody repair techniques. [SA-B8-12] 3.G.2

3 Demonstrate advanced welding applications. [WE-A12-15] 3.G.3

4 Replace structural components following manufacturer specifications. [SA-B13-16] 3.G.4

5 Implement proper corrosion protection measures. [SA-B17-19] 3.G.5

H The student masters integration and documentation procedures. The student is expected to: 3.H

1 Conduct comprehensive quality control inspections. [DAECS-B21-23] 3.H.1

2 Create detailed repair documentation. [DAECS-A16-20] 3.H.2

3 Perform customer service procedures. [DAECS-D1-6] 3.H.3

4 Evaluate repair outcomes against manufacturer specifications. [DAECS-B20-22] 3.H.4

5 Develop solutions for complex repair issues. [DAECS-D7-12] 3.H.5