

# Transportation, Distribution, and Logistics (2021)

Adopted 2021

## Automotive Technologies 1 (47.45)

### **TDL-AT1-GS-1. Demonstrate employability skills required by business and industry.** TDL-AT1-GS-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AT1-GS-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AT1-GS-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AT1-GS-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AT1-GS-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AT1-GS-1.5
6. Present a professional image through appearance, behavior and language. TDL-AT1-GS-1.6

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**TDL-AT1-GS-2. Identify and utilize safety procedures and proper tools.** TDL-AT1-GS-2

1. Identify general shop safety rules and procedures. TDL-AT1-GS-2.1
2. Utilize safe procedures for handling of tools and equipment 2.3  
Identify and use proper placement of floor jacks and jack stands. TDL-AT1-GS-2.2
4. Identify and use proper procedures for safe lift operation. TDL-AT1-GS-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AT1-GS-2.5
6. Identify marked safety areas. TDL-AT1-GS-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AT1-GS-2.7
8. Identify the location and use of eye wash stations. TDL-AT1-GS-2.8
9. Identify the location of the posted evacuation routes. TDL-AT1-GS-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AT1-GS-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-AT1-GS-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-AT1-GS-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AT1-GS-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc. TDL-AT1-GS-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AT1-GS-2.15

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**TDL-AT1-GS-3. Research and utilize proper tools and equipment.** TDL-AT1-GS-3

1. Identify tools and their usage in automotive applications. TDL-AT1-GS-3.1
2. Identify standard and metric designations. TDL-AT1-GS-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AT1-GS-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AT1-GS-3.4
5. Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, and dial-caliper). TDL-AT1-GS-3.5

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**TDL-AT1-GS-4. Research and utilize vehicle service information.** TDL-AT1-GS-4

1. Identify information needed and the service requested on a repair order. TDL-AT1-GS-4.1
2. Identify purpose and demonstrate proper use of fender covers and mats. TDL-AT1-GS-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AT1-GS-4.3
4. Review vehicle service history. TDL-AT1-GS-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AT1-GS-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AT1-GS-4.6
7. Identify and use applicable service information materials to include service manuals, manufacturer service information, and bulletins to develop a process/procedure for diagnostics. TDL-AT1-GS-4.7

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**TDL-AT1-GS-5. Develop an understanding of automotive careers, describing the principal fields of specializations and identifying associated career opportunities.** TDL-AT1-GS-5

1. Identify education requirements for automotive occupations and locations where programs of study are available. TDL-AT1-GS-5.1
2. Match automotive job titles with qualifications and responsibilities. TDL-AT1-GS-5.2
3. Participate in activities related to career interests. TDL-AT1-GS-5.3

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**TDL-AT1-GS-6. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** TDL-AT1-GS-6

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-AT1-GS-6.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-AT1-GS-6.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-AT1-GS-6.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including, but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-AT1-GS-6.4

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**Automotive  
Technologies 2 (47.451)**

**TDL-AT2-GS-1. Demonstrate employability skills required by business and industry.** TDL-AT2-GS-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AT2-GS-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AT2-GS-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AT2-GS-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AT2-GS-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AT2-GS-1.5
6. Present a professional image through appearance, behavior and language. TDL-AT2-GS-1.6

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**TDL-AT2-GS-2. Identify and utilize safety procedures and proper tools.** TDL-AT2-GS-2

1. Identify general shop safety rules and procedures. TDL-AT2-GS-2.1
2. Utilize safe procedures for handling of tools and equipment 2.3  
Identify and use proper placement of floor jacks and jack stands. TDL-AT2-GS-2.2
4. Identify and use proper procedures for safe lift operation. TDL-AT2-GS-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AT2-GS-2.5
6. Identify marked safety areas. TDL-AT2-GS-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AT2-GS-2.7
8. Identify the location and use of eye wash stations. TDL-AT2-GS-2.8
9. Identify the location of the posted evacuation routes. TDL-AT2-GS-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AT2-GS-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-AT2-GS-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-AT2-GS-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AT2-GS-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc. TDL-AT2-GS-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AT2-GS-2.15

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**TDL-AT2-GS-3. Research and utilize proper tools and equipment.** TDL-AT2-GS-3

1. Identify tools and their usage in automotive applications. TDL-AT2-GS-3.1
2. Identify standard and metric designations. TDL-AT2-GS-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AT2-GS-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AT2-GS-3.4
5. Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, and dial-caliper). TDL-AT2-GS-3.5

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**TDL-AT2-GS-4. Research and utilize vehicle service information.** TDL-AT2-GS-4

1. Identify information needed and the service requested on a repair order. TDL-AT2-GS-4.1
2. Identify purpose and demonstrate proper use of fender covers and mats. TDL-AT2-GS-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AT2-GS-4.3
4. Review vehicle service history. TDL-AT2-GS-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AT2-GS-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AT2-GS-4.6
7. Identify and use applicable service information materials to include service manuals, manufacturer service information, and bulletins to develop a process/procedure for diagnostics. TDL-AT2-GS-4.7

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**TDL-AT2-GS-5. Develop an understanding of automotive careers, describing the principal fields of specializations and identifying associated career opportunities.** TDL-AT2-GS-5

1. Identify education requirements for automotive occupations and locations where programs of study are available. TDL-AT2-GS-5.1
2. Match automotive job titles with qualifications and responsibilities. TDL-AT2-GS-5.2
3. Participate in activities related to career interests. TDL-AT2-GS-5.3

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**TDL-AT2-GS-6. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** TDL-AT2-GS-6

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-AT2-GS-6.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-AT2-GS-6.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-AT2-GS-6.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including, but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-AT2-GS-6.4

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**Automotive  
Technologies 3 (47.452)**

**TDL-AT3-GS-1. Demonstrate employability skills required by business and industry.** TDL-AT3-GS-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AT3-GS-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AT3-GS-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AT3-GS-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AT3-GS-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AT3-GS-1.5
6. Present a professional image through appearance, behavior and language. TDL-AT3-GS-1.6

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**TDL-AT3-GS-2. Identify and utilize safety procedures and proper tools.** TDL-AT3-GS-2

1. Identify general shop safety rules and procedures. TDL-AT3-GS-2.1
2. Utilize safe procedures for handling of tools and equipment 2.3  
Identify and use proper placement of floor jacks and jack stands. TDL-AT3-GS-2.2
4. Identify and use proper procedures for safe lift operation. TDL-AT3-GS-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AT3-GS-2.5
6. Identify marked safety areas. TDL-AT3-GS-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AT3-GS-2.7
8. Identify the location and use of eye wash stations. TDL-AT3-GS-2.8
9. Identify the location of the posted evacuation routes. TDL-AT3-GS-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AT3-GS-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-AT3-GS-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-AT3-GS-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AT3-GS-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc. TDL-AT3-GS-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AT3-GS-2.15

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**TDL-AT3-GS-3. Research and utilize proper tools and equipment.** TDL-AT3-GS-3

1. Identify tools and their usage in automotive applications. TDL-AT3-GS-3.1
2. Identify standard and metric designations. TDL-AT3-GS-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AT3-GS-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AT3-GS-3.4
5. Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, and dial-caliper). TDL-AT3-GS-3.5

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**TDL-AT3-GS-4. Research and utilize vehicle service information.** TDL-AT3-GS-4

1. Identify information needed and the service requested on a repair order. TDL-AT3-GS-4.1
2. Identify purpose and demonstrate proper use of fender covers and mats. TDL-AT3-GS-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AT3-GS-4.3
4. Review vehicle service history. TDL-AT3-GS-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AT3-GS-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AT3-GS-4.6
7. Identify and use applicable service information materials to include service manuals, manufacturer service information, and bulletins to develop a process/procedure for diagnostics. TDL-AT3-GS-4.7

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**TDL-AT3-GS-5. Develop an understanding of automotive careers, describing the principal fields of specializations and identifying associated career opportunities.** TDL-AT3-GS-5

1. Identify education requirements for automotive occupations and locations where programs of study are available. TDL-AT3-GS-5.1
2. Match automotive job titles with qualifications and responsibilities. TDL-AT3-GS-5.2
3. Participate in activities related to career interests. TDL-AT3-GS-5.3

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**TDL-AT3-GS-6. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** TDL-AT3-GS-6

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-AT3-GS-6.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-AT3-GS-6.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-AT3-GS-6.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including, but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-AT3-GS-6.4

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**Advanced Automotive Technologies 4 (47.444)**

**TDL-AT4-GS-1. Demonstrate employability skills required by business and industry.** TDL-AT4-GS-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AT4-GS-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AT4-GS-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AT4-GS-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AT4-GS-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AT4-GS-1.5
6. Present a professional image through appearance, behavior and language. TDL-AT4-GS-1.6

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**TDL-AT4-GS-2. Identify and utilize safety procedures and proper tools.** TDL-AT4-GS-2

1. Identify general shop safety rules and procedures. TDL-AT4-GS-2.1
2. Utilize safe procedures for handling of tools and equipment. TDL-AT4-GS-2.2
3. Identify and use proper placement of floor jacks and jack stands. TDL-AT4-GS-2.3
4. Identify and use proper procedures for safe lift operation. TDL-AT4-GS-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AT4-GS-2.5
6. Identify marked safety areas. TDL-AT4-GS-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AT4-GS-2.7
8. Identify the location and use of eye wash stations. TDL-AT4-GS-2.8
9. Identify the location of the posted evacuation routes. TDL-AT4-GS-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AT4-GS-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-AT4-GS-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-AT4-GS-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AT4-GS-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc. TDL-AT4-GS-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AT4-GS-2.15

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**TDL-AT4-GS-3. Research and utilize proper tools and equipment.** TDL-AT4-GS-3

1. Identify tools and their usage in automotive applications. TDL-AT4-GS-3.1
2. Identify standard and metric designations. TDL-AT4-GS-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AT4-GS-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AT4-GS-3.4
5. Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, and dial-caliper). TDL-AT4-GS-3.5

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**TDL-AT4-GS-4. Research and utilize vehicle service information.** TDL-AT4-GS-4

1. Identify information needed and the service requested on a repair order. 4.2 Identify purpose and demonstrate proper use of fender covers and mats. 4.3 Demonstrate use of the three C's (concern, cause, and correction). TDL-AT4-GS-4.1
4. Review vehicle service history. TDL-AT4-GS-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AT4-GS-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AT4-GS-4.6
7. Identify and use applicable service information materials to include service manuals, manufacturer service information, and bulletins to develop a process/procedure for diagnostics. TDL-AT4-GS-4.7

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**TDL-AT4-GS-5. Develop an understanding of automotive careers, describing the principal fields of specializations and identifying associated career opportunities.** TDL-AT4-GS-5

1. Identify education requirements for automotive occupations and locations where programs of study are available. TDL-AT4-GS-5.1
2. Match automotive job titles with qualifications and responsibilities. TDL-AT4-GS-5.2
3. Participate in activities related to career interests. TDL-AT4-GS-5.3

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**TDL-AT4-GS-6. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** TDL-AT4-GS-6

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-AT4-GS-6.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-AT4-GS-6.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-AT4-GS-6.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including, but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-AT4-GS-6.4

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**Advanced Automotive Technologies 5 (44.445)**

**TDL-AT5-GS-1. Demonstrate employability skills required by business and industry.** TDL-AT5-GS-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AT5-GS-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AT5-GS-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AT5-GS-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AT5-GS-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AT5-GS-1.5
6. Present a professional image through appearance, behavior and language. TDL-AT5-GS-1.6

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**TDL-AT5-GS-2. Identify and utilize safety procedures and proper tools.** TDL-AT5-GS-2

1. Identify general shop safety rules and procedures. TDL-AT5-GS-2.1
2. Utilize safe procedures for handling of tools and equipment. TDL-AT5-GS-2.2
3. Identify and use proper placement of floor jacks and jack stands. TDL-AT5-GS-2.3
4. Identify and use proper procedures for safe lift operation. TDL-AT5-GS-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AT5-GS-2.5
6. Identify marked safety areas. TDL-AT5-GS-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AT5-GS-2.7
8. Identify the location and use of eye wash stations. TDL-AT5-GS-2.8
9. Identify the location of the posted evacuation routes. TDL-AT5-GS-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AT5-GS-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-AT5-GS-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-AT5-GS-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AT5-GS-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc. TDL-AT5-GS-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AT5-GS-2.15

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**TDL-AT5-GS-3. Research and utilize proper tools and equipment.** TDL-AT5-GS-3

1. Identify tools and their usage in automotive applications. TDL-AT5-GS-3.1
2. Identify standard and metric designations. TDL-AT5-GS-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AT5-GS-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AT5-GS-3.4
5. Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, and dial-caliper). TDL-AT5-GS-3.5

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**TDL-AT5-GS-4. Research and utilize vehicle service information.** TDL-AT5-GS-4

1. Identify information needed and the service requested on a repair order. TDL-AT5-GS-4.1
2. Identify purpose and demonstrate proper use of fender covers and mats. TDL-AT5-GS-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AT5-GS-4.3
4. Review vehicle service history. TDL-AT5-GS-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AT5-GS-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AT5-GS-4.6
7. Identify and use applicable service information materials to include service manuals, manufacturer service information, and bulletins to develop a process/procedure for diagnostics. TDL-AT5-GS-4.7

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**TDL-AT5-GS-5. Develop an understanding of automotive careers, describing the principal fields of specializations and identifying associated career opportunities.** TDL-AT5-GS-5

1. Identify education requirements for automotive occupations and locations where programs of study are available. TDL-AT5-GS-5.1
2. Match automotive job titles with qualifications and responsibilities. TDL-AT5-GS-5.2
3. Participate in activities related to career interests. TDL-AT5-GS-5.3

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**TDL-AT5-GS-6. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** TDL-AT5-GS-6

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-AT5-GS-6.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-AT5-GS-6.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-AT5-GS-6.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including, but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-AT5-GS-6.4

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**Advanced Automotive Technologies 6 (47.446)**

**TDL-AT6-GS-1. Demonstrate employability skills required by business and industry.** TDL-AT6-GS-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AT6-GS-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AT6-GS-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AT6-GS-1.3
4. accountability, punctuality, time management, and respect for diversity. TDL-AT6-GS-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AT6-GS-1.5
6. Present a professional image through appearance, behavior and language. TDL-AT6-GS-1.6

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**TDL-AT6-GS-2. Identify and utilize safety procedures and proper tools.** TDL-AT6-GS-2

1. Identify general shop safety rules and procedures. TDL-AT6-GS-2.1
2. Utilize safe procedures for handling of tools and equipment. TDL-AT6-GS-2.2
3. Identify and use proper placement of floor jacks and jack stands. TDL-AT6-GS-2.3
4. Identify and use proper procedures for safe lift operation. TDL-AT6-GS-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AT6-GS-2.5
6. Identify marked safety areas. TDL-AT6-GS-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AT6-GS-2.7
8. Identify the location and use of eye wash stations. TDL-AT6-GS-2.8
9. Identify the location of the posted evacuation routes. TDL-AT6-GS-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AT6-GS-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-AT6-GS-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-AT6-GS-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AT6-GS-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc. TDL-AT6-GS-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AT6-GS-2.15

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**TDL-AT6-GS-3. Research and utilize proper tools and equipment.** TDL-AT6-GS-3

1. Identify tools and their usage in automotive applications. TDL-AT6-GS-3.1
2. Identify standard and metric designations. TDL-AT6-GS-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AT6-GS-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AT6-GS-3.4
5. Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, and dial-caliper). TDL-AT6-GS-3.5

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**TDL-AT6-GS-4. Research and utilize vehicle service information.** TDL-AT6-GS-4

1. Identify information needed and the service requested on a repair order. TDL-AT6-GS-4.1
2. Identify purpose and demonstrate proper use of fender covers and mats. TDL-AT6-GS-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AT6-GS-4.3
4. Review vehicle service history. TDL-AT6-GS-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AT6-GS-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AT6-GS-4.6
7. Identify and use applicable service information materials to include service manuals, manufacturer service information, and bulletins to develop a process/procedure for diagnostics. TDL-AT6-GS-4.7

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**TDL-AT6-GS-5. Develop an understanding of automotive careers, describing the principal fields of specializations and identifying associated career opportunities.** TDL-AT6-GS-5

1. Identify education requirements for automotive occupations and locations where programs of study are available. TDL-AT6-GS-5.1
2. Match automotive job titles with qualifications and responsibilities. TDL-AT6-GS-5.2
3. Participate in activities related to career interests. TDL-AT6-GS-5.3

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**TDL-AT6-GS-6. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** TDL-AT6-GS-6

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-AT6-GS-6.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-AT6-GS-6.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-AT6-GS-6.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including, but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-AT6-GS-6.4

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**Automobile Service  
Technology 4 (47.434)**

**TDL-AST4-1. Demonstrate employability skills required by business and industry.** TDL-AST4-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AST4-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AST4-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AST4-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AST4-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AST4-1.5
6. Present a professional image through appearance, behavior and language. TDL-AST4-1.6

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**TDL-AST4-2. Identify and utilize safety procedures and proper tools for shop and personal safety.** TDL-AST4-2

1. Identify general shop safety rules and procedures. TDL-AST4-2.1
2. Utilize safe procedures for handling of tools and equipment. TDL-AST4-2.2
3. Identify and use proper placement of floor jacks and jack stands. TDL-AST4-2.3
4. Identify and use proper procedures for safe lift operation. TDL-AST4-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AST4-2.5
6. Identify marked safety areas. TDL-AST4-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment, demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AST4-2.7
8. Identify the location and use of eye wash stations. TDL-AST4-2.8
9. Identify the location of the posted evacuation routes. TDL-AST4-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AST4-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-AST4-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-AST4-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AST4-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.). TDL-AST4-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AST4-2.15

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**TDL-AST4-3. Identify and utilize proper tools and equipment.** TDL-AST4-3

1. Identify tools and their usage in automotive applications. TDL-AST4-3.1
2. Identify standard and metric designation. TDL-AST4-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AST4-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AST4-3.4
5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper). TDL-AST4-3.5

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**TDL-AST4-4. Identify and utilize vehicle service information.** TDL-AST4-4

1. Identify information needed and the service requested on a repair order. TDL-AST4-4.1
2. Identify purpose and demonstrate proper use of fender covers, mats. TDL-AST4-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AST4-4.3
4. Review vehicle service history. TDL-AST4-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AST4-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AST4-4.6

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**TDL-AST4-5. Demonstrate and explain general engine service techniques relating to general engine diagnosis, removal and reinstallation, and lubrication and cooling system diagnosis and repair.** TDL-AST4-5

1. Inspect, remove and replace engine mounts (P-2). TDL-AST4-5.1
2. Identify causes of engine overheating (P-1). TDL-AST4-5.2
3. Inspect, remove, and replace water pump (P-2). TDL-AST4-5.3
4. Remove and replace radiator (P-2). TDL-AST4-5.4
5. Inspect and test fan(s) (electrical or mechanical), fan clutch, fan shroud, and air dams (P-1). TDL-AST4-5.5
6. Perform oil pressure tests; determine necessary action (P-1). TDL-AST4-5.6
7. Inspect auxiliary coolers; determine necessary action (P-3). TDL-AST4-5.7
8. Inspect, test, and replace oil temperature and pressure switches and sensors (P-2). TDL-AST4-5.8

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**TDL-AST4-6. Perform general automatic transmission and manual transaxle and differential service.** TDL-AST4-6

1. Diagnose fluid loss and condition concerns; determine necessary action (P-1). TDL-AST4-6.1
2. Inspect, test, adjust, repair, or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses (P-1). TDL-AST4-6.2
3. Inspect, leak test, and flush or replace transmission/transaxle oil cooler, lines, and fittings (P-1). TDL-AST4-6.3
4. Identify and interpret drive train concerns; determine necessary action (P-1). TDL-AST4-6.4
5. Check fluid condition; check for leaks; determine necessary action (P-1). TDL-AST4-6.5
6. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action (P-1). TDL-AST4-6.6
7. Bleed clutch hydraulic system (P-1). TDL-AST4-6.7
8. Inspect flywheel and ring gear for wear and cracks; determine necessary action (P-1). TDL-AST4-6.8

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**TDL-AST4-7. Prepare vehicle for general suspension and steering systems service, including wheel alignment diagnosis, adjustment and repair.** TDL-AST4-7

1. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine necessary action (P-1). TDL-AST4-7.1
2. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action (P-1). TDL-AST4-7.2
3. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action (P-1). TDL-AST4-7.3
4. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber; and toe as required; center steering wheel (P-1). TDL-AST4-7.4
5. Check toe-out-on-turns (turning radius); determine necessary action (P-2). TDL-AST4-7.5
6. Check SAI (steering axis inclination) and included angle; determine necessary action (P-2). TDL-AST4-7.6
7. Check rear wheel thrust angle; determine necessary action (P-1). TDL-AST4-7.7
8. Check for front wheel setback; determine necessary action (P-2). TDL-AST4-7.8
9. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action (P-2). TDL-AST4-7.9
10. Measure wheel, tire, axle flange, and hub runout; determine necessary action (P-2). TDL-AST4-7.10
11. Diagnose tire pull problems; determine necessary action (P-2). TDL-AST4-7.11

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**TDL-AST4-8. Perform hydraulic brake system service and repairs.** TDL-AST4-8

1. Identify and interpret brake system concerns; determine necessary action (P-1). TDL-AST4-8.1
2. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law) (P-1). TDL-AST4-8.2
3. Remove, bench bleed, and reinstall master cylinder (P-1). TDL-AST4-8.3
4. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action (P-3). TDL-AST4-8.4
5. Replace brake lines, hoses, fittings, and supports (P-2). TDL-AST4-8.5
6. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types) (P-2). TDL-AST4-8.6
7. Inspect, test, and/or replace components of brake warning light system (P-3). TDL-AST4-8.7

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**TDL-AST4-9. Perform general electrical systems service and diagnose and repair the charging system, horn and wiper/washer, and automobile accessories.** TDL-AST4-9

1. Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems (P-1). TDL-AST4-9.1
2. Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; determine necessary action (P-1). TDL-AST4-9.2
3. Repair wiring harness (P-3). TDL-AST4-9.3
4. Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions (P-1). TDL-AST4-9.4
5. Diagnose (troubleshoot) causes of incorrect horn operation; perform necessary action (P-1). TDL-AST4-9.5
6. Diagnose (troubleshoot) windshield washer problems; perform necessary action (P-2). TDL-AST4-9.6
7. Diagnose (troubleshoot) incorrect operation of motor-driven accessory circuits; determine necessary action (P-2). TDL-AST4-9.7

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**TDL-AST4-10. Analyze engine performance to diagnose and repair issues related to the engine, ignition system, and fuel, air induction, and exhaust systems.** TDL-AST4-10

1. Identify and interpret engine performance concerns; determine necessary action (P-1). TDL-AST4-10.1
2. Diagnose abnormal engine noises or vibration concerns; determine necessary action (P-3). TDL-AST4-10.2
3. Diagnose the cause of excessive oil consumption, coolant consumption, unusual exhaust color, odor, and sound; determine necessary action (P-2). TDL-AST4-10.3
4. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action (P-2). TDL-AST4-10.4
5. Verify correct camshaft timing (P-1). TDL-AST4-10.5
6. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action (P-1). TDL-AST4-10.6
7. Check fuel for contaminants; determine necessary action (P-2). TDL-AST4-10.7
8. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action (P-1). TDL-AST4-10.8
9. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air (P-2). TDL-AST4-10.9
10. Verify idle control operation (P-1). TDL-AST4-10.10

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**TDL-AST4-11. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-AST4-11

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-AST4-11.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-AST4-11.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-AST4-11.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-AST4-11.4
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**Automobile Service  
Technology 5 (47.435)**

**TDL-AST5-1. The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways. TDL-AST5-1**

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AST5-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AST5-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AST5-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AST5-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AST5-1.5
6. Present a professional image through appearance, behavior and language. TDL-AST5-1.6

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**TDL-AST5-2. Identify and utilize personal safety procedures and proper use of tools in the automotive shop.** TDL-AST5-2

1. Identify general shop safety rules and procedures. TDL-AST5-2.1
2. Utilize safe procedures for handling of tools and equipment. TDL-AST5-2.2
3. Identify and use proper placement of floor jacks and jack stands. TDL-AST5-2.3
4. Identify and use proper procedures for safe lift operation. TDL-AST5-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AST5-2.5
6. Identify marked safety areas. TDL-AST5-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AST5-2.7
8. Identify the location and use of eye wash stations. TDL-AST5-2.8
9. Identify the location of the posted evacuation routes. TDL-AST5-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AST5-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-AST5-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-AST5-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AST5-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.). TDL-AST5-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AST5-2.15

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**TDL-AST5-3. Identify and utilize proper tools and equipment in the automotive shop.** TDL-AST5-3

1. Identify tools and the usage in automotive applications. TDL-AST5-3.1
2. Identify standard and metric designation. TDL-AST5-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AST5-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AST5-3.4
5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, and dialcaliper). TDL-AST5-3.5

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**TDL-AST5-4. Identify and utilize vehicle service information and prepare the vehicle for the customer.** TDL-AST5-4

1. Identify information needed and the service requested on a repair order. TDL-AST5-4.1
2. Identify purpose and demonstrate proper use of fender covers, and mats. TDL-AST5-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AST5-4.3
4. Review vehicle service history. TDL-AST5-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AST5-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AST5-4.6

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**TDL-AST5-5. Demonstrate general engine service techniques when repairing and diagnosing cylinder head and valve train issues.** TDL-AST5-5

1. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures (P-1). TDL-AST5-5.1
2. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition (P-1). TDL-AST5-5.2
3. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action (P-2). TDL-AST5-5.3
4. Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components; verify correct camshaft timing (P-1). TDL-AST5-5.4

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**TDL-AST5-6. Perform general automatic transmission and manual transaxle and differential service.** TDL-AST5-6

1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action (P-1). TDL-AST5-6.1
2. Remove and replace drive axle shafts (P-1). TDL-AST5-6.2
3. Inspect and replace drive axle shaft seals, bearings, and retainers (P-2). TDL-AST5-6.3
4. Measure drive axle flange runout and shaft end play; determine necessary action (P-2). TDL-AST5-6.4

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**TDL-AST5-7. Prepare vehicle for general suspension and steering systems service.** TDL-AST5-7

1. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring) (P-1). TDL-AST5-7.1
2. Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action (P-2). TDL-AST5-7.2
3. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action (P-2). TDL-AST5-7.3
4. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action (P-2). TDL-AST5-7.4
5. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action (P-2). TDL-AST5-7.5
6. Remove and reinstall power steering pump (P-2). TDL-AST5-7.6
7. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment (P-2). TDL-AST5-7.7
8. Inspect, remove and install strut rods and bushings (P-3). TDL-AST5-7.8
9. Inspect, remove and install track bar, strut rods/radius arms, and related mounts and bushings (P-3). TDL-AST5-7.9
10. Inspect rear suspension system leaf spring(s), bushings, center pins/bolts, and mounts (P-1). TDL-AST5-7.10
11. Remove, inspect, and service or replace front and rear wheel bearings (P-1). TDL-AST5-7.11

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**TDL-AST5-8. Perform hydraulic brake system service and repairs and diagnose and repair wheel bearings, parking brakes, and related electrical.** TDL -

AST5-8

1. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action (P-1). TDL-AST5-8.1
2. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine necessary action (P-1). TDL-AST5-8.2
3. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine necessary action (P-1). TDL-AST5-8.3
4. Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine necessary action (P-3). TDL-AST5-8.4
5. Measure and adjust master cylinder pushrod length (P-3). TDL-AST5-8.5
6. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action (P-3). TDL-AST5-8.6
7. Remove and reinstall sealed wheel bearing assembly (P-2). TDL-AST5-8.7
8. Identify and inspect electronic brake control system components; determine necessary action (P-1). TDL-AST5-8.8

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**TDL-AST5-9. Perform general electrical systems service and diagnose and repair gauges, warning devices, and driver information systems.** TDL-AST5-9

1. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action (P-1). TDL-AST5-9.1
2. Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine necessary action (P-1). TDL-AST5-9.2
3. Inspect and test gauges and gauge sending units for causes of abnormal gauge readings; determine necessary action (P-2). TDL-AST5-9.3

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**TDL-AST5-10. Demonstrate diagnosis and repair knowledge for A/C systems.** TDL - AST5-10

1. Identify and interpret heating and air conditioning problems; determine necessary action (P-1). TDL-AST5-10.1
2. Identify refrigerant type; select and connect proper gauge set; record temperature and pressure readings (P-1). TDL-AST5-10.2
3. Leak test A/C system; determine necessary action (P-1). TDL-AST5-10.3
4. Inspect, test, service or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed (P-2). TDL-AST5-10.4
5. Remove, inspect, and install expansion valve or orifice (expansion) tube (P-1). TDL-AST5-10.5
6. Inspect evaporator housing water drain; perform necessary action (P-1). TDL-AST5-10.6
7. Inspect and test heater control valve(s); perform necessary action (P-2). TDL-AST5-10.7
8. Inspect and test A/C-heater blower motors, resistors, switches, relays, wiring, and protection devices; perform necessary action (P-1). TDL-AST5-10.8
9. Identify and recover A/C system refrigerant (P-1). TDL-AST5-10.9

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**TDL-AST5-11. Analyze engine performance by using computerized engine and emissions control systems.** TDL-AST5-11

1. Access and use service information to perform step-by-step (troubleshooting) diagnosis (P-1). TDL-AST5-11.1
  2. Perform active tests of actuators using a scan tool; determine necessary action (P-2). TDL-AST5-11.2
  3. Diagnose oil leaks, emissions, and drivability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action (P-3). TDL-AST5-11.3
  4. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action (P-3). TDL-AST5-11.4
  5. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action (P-1). TDL-AST5-11.5
  6. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action (P-3). TDL-AST5-11.6
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**Automobile Service  
Technology 6 (47.436)**

**TDL-AST6-1. The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways.** TDL-AST6-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AST6-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AST6-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AST6-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AST6-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AST6-1.5
6. Present a professional image through appearance, behavior and language. TDL-AST6-1.6

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**TDL-AST6-2. Identify and utilize safety procedures and proper tools.** TDL-AST6-2

1. Identify general shop safety rules and procedures. TDL-AST6-2.1
2. Utilize safe procedures for handling of tools and equipment. TDL-AST6-2.2
3. Identify and use proper placement of floor jacks and jack stands. TDL-AST6-2.3
4. Identify and use proper procedures for safe lift operation. TDL-AST6-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AST6-2.5
6. Identify marked safety areas. TDL-AST6-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AST6-2.7
8. Identify the location and use of eye wash stations. TDL-AST6-2.8
9. Identify the location of the posted evacuation routes. TDL-AST6-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AST6-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-AST6-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-AST6-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AST6-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.). TDL-AST6-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AST6-2.15

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**TDL-AST6-3. Identify and utilize proper tools and equipment.** TDL-AST6-3

1. Identify tools and their usage in automotive applications. TDL-AST6-3.1
2. Identify standard and metric designation. TDL-AST6-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AST6-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AST6-3.4
5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, and dial-caliper). TDL-AST6-3.5

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**TDL-AST6-4. Identify and utilize vehicle service information.** TDL-AST6-4

1. Identify information needed and the service requested on a repair order. TDL-AST6-4.1
2. Identify purpose and demonstrate proper use of fender covers, mats. TDL-AST6-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AST6-4.3
4. Review vehicle service history. TDL-AST6-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AST6-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AST6-4.6

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**TDL-AST6-5. Demonstrate General Engine Service Techniques.** TDL-AST6-5

1. Inspect, remove and replace engine mounts (P-2). TDL-AST6-5.1
2. Remove and reinstall engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition (P-3). TDL-AST6-5.2
3. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures (P-1). TDL-AST6-5.3
4. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition (P-1). TDL-AST6-5.4
5. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action (P-2). TDL-AST6-5.5
6. Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components; verify correct camshaft timing (P-1). TDL-AST6-5.6
7. Establish camshaft position sensor indexing (P-1). TDL-AST6-5.7

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**TDL-AST6-6. Prepare vehicle for general suspension and steering systems service.** TDL-AST6-6

1. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets (P-2). TDL-AST6-6.1
2. Inspect, remove and install upper and lower control arms, bushings, shafts, and rebound bumpers (P-3). TDL-AST6-6.2
3. Inspect, remove and install upper and/or lower ball joints (with or without wear indicators) (P-3). TDL-AST6-6.3
4. Inspect, remove and install steering knuckle assemblies (P-3). TDL-AST6-6.4
5. Inspect, remove and install short and long arm suspension system coil springs and spring insulators (P-3). TDL-AST6-6.5
6. Inspect, remove and install torsion bars and mounts (P-3). TDL-AST6-6.6
7. Check front and/or rear cradle (subframe) alignment; determine necessary action (P-3). TDL-AST6-6.7

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**TDL-AST6-7. Perform general electrical systems service.** TDL-AST6-7

1. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition (P-2). TDL-AST6-7.1
2. Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems and determine necessary action (P-2). TDL-AST6-7.2
3. Diagnose (troubleshoot) causes of incorrect wiper operation, diagnose wiper speed control and park problems, and determine necessary action (P-2). TDL-AST6-7.3
4. Diagnose (troubleshoot) incorrect electric lock operation (including remote keyless entry) and determine necessary action (P-2). TDL-AST6-7.4
5. Diagnose (troubleshoot) incorrect operation of cruise control systems and determine necessary action (P-3). TDL-AST6-7.5
6. Diagnose (troubleshoot) supplemental restraint systems (SRS) problems and determine necessary action (P-2). TDL-AST6-7.6
7. Check for module communication errors (including CAN/BUS systems) using a scan tool (P-2). TDL-AST6-7.7

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**TDL-AST6-8. Demonstrate knowledge of air conditioning systems.** TDL-AST6-8

1. Demonstrate performance testing of the air conditioning system and identify problems (P-1). TDL-AST6-8.1
2. Identify abnormal operating noises in the air conditioning system and determine necessary action (P-2). TDL-AST6-8.2
3. Determine recommended oil and oil capacity for system application (P-1). TDL-AST6-8.3
4. Using a scan tool, observe and record related HVAC data and trouble codes (P-3). TDL-AST6-8.4
5. Inspect, test, service or replace air conditioning compressor clutch components and/or assembly; check the compressor clutch air gap and adjust as needed (P-2). TDL-AST6-8.5
6. Remove, inspect, and reinstall air conditioning compressor and mountings and determine recommended oil quantity (P-2). TDL-AST6-8.6
7. Determine the need for an additional air conditioning system filter and perform necessary action (P-3). TDL-AST6-8.7
8. Remove and inspect air conditioning system mufflers, hoses, lines, fittings, O-rings, seals, and service valves and perform necessary action (P-2). TDL-AST6-8.8
9. Remove, inspect, and reinstall receiver/drier or accumulator/drier and determine recommended oil quantity (P-2). TDL-AST6-8.9
10. Remove, inspect, and install expansion valve or orifice (expansion) tube (P-1). TDL-AST6-8.10
11. Diagnose A/C compressor clutch control systems; determine necessary action (P-2). TDL-AST6-8.11
12. Diagnose malfunctions in the vacuum, mechanical, and electrical components and the electrical controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action (P-2). TDL-AST6-8.12
13. Inspect and test A/C-heater control panel assembly; determine necessary action (P-3). TDL-AST6-8.13
14. Inspect and test A/C-heater control cables, motors, and linkages; perform necessary action (P-3). TDL-AST6-8.14
15. Check operation of automatic or semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action (P-2). TDL-AST6-8.15
16. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards (P-1). TDL-AST6-8.16
17. Recycle, label, and store refrigerant (P-1). TDL-AST6-8.17

18. Evacuate and charge A/C system; add refrigerant oil as required (P-1). [TDL-AST6-8.18](#)
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**TDL-AST6-9. Analyze Engine Performance.** [TDL-AST6-9](#)

1. Diagnose (troubleshoot) ignition system related problems such as no-starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action (P-2). [TDL-AST6-9.1](#)
  2. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary (P-3). [TDL-AST6-9.2](#)
  3. Inspect and test fuel injectors (P-2). [TDL-AST6-9.3](#)
  4. Perform exhaust system back-pressure test; determine necessary action (P-2). [TDL-AST6-9.4](#)
  5. Diagnose emissions and drivability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action (P-3). [TDL-AST6-9.5](#)
  6. Inspect, test, service, and replace components of the EGR system including tubing, exhaust passages, vacuum/pressure controls, filters, and hoses; perform necessary action (P-2). [TDL-AST6-9.6](#)
  7. Inspect and test catalytic converter efficiency (P-2). [TDL-AST6-9.7](#)
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**Automobile Service  
Technology 7 (47.437)**

**TDL-AST7-1. The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways.** [TDL-AST7-1](#)

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. [TDL-AST7-1.1](#)
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. [TDL-AST7-1.2](#)
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. [TDL-AST7-1.3](#)
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. [TDL-AST7-1.4](#)
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. [TDL-AST7-1.5](#)
6. Present a professional image through appearance, behavior and language. [TDL-AST7-1.6](#)

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**TDL-AST7-2. Identify and utilize safety procedures and proper tools.** TDL-AST7-2

1. Identify and use general shop safety rules and procedures. TDL-AST7-2.1
2. Utilize safe procedures for handling of tools and equipment. TDL-AST7-2.2
3. Identify and use proper placement of floor jacks and jack stands. TDL-AST7-2.3
4. Identify and use proper procedures for safe lift operation. TDL-AST7-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AST7-2.5
6. Identify and use marked safety areas. TDL-AST7-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment. TDL-AST7-2.7
8. Demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AST7-2.8
9. Identify and use the location and use of eye wash stations. TDL-AST7-2.9
10. Identify and use the location of the posted evacuation routes. TDL-AST7-2.10
11. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AST7-2.11
12. Identify and wear appropriate clothing for lab/shop activities. TDL-AST7-2.12
13. Demonstrate securing hair and jewelry for lab/shop activities. TDL-AST7-2.13
14. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AST7-2.14
15. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.). TDL-AST7-2.15
16. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AST7-2.16

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**TDL-AST7-3. Identify and utilize proper tools and equipment.** TDL-AST7-3

1. Identify tools and the proper usage in automotive applications. TDL-AST7-3.1
2. Identify and properly use standard and metric designation. TDL-AST7-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AST7-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AST7-3.4
5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dial-caliper). TDL-AST7-3.5

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**TDL-AST7-4. Identify and utilize vehicle service information.** TDL-AST7-4

1. Identify information needed and the service requested on a repair order. TDL-AST7-4.1
2. Identify purpose and demonstrate proper use of fender covers, mats. TDL-AST7-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AST7-4.3
4. Review vehicle service history. TDL-AST7-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AST7-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AST7-4.6

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**TDL-AST7-5. Demonstrate general engine service techniques.** TDL-AST7-5

1. Inspect valve springs for squareness and free height comparison; determine necessary action (P-3). TDL-AST7-5.1
2. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action (P-3). TDL-AST7-5.2
3. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action (P-3). TDL-AST7-5.3
4. Inspect valves and valve seats; determine necessary action (P-3). TDL-AST7-5.4
5. Check valve spring assembled height and valve stem height; determine necessary action (P-3). TDL-AST7-5.5
6. Inspect valve lifters; determine necessary action (P-2). TDL-AST7-5.6
7. Inspect and/or measure camshaft for run out, journal wear and lobe wear (P-2). TDL-AST7-5.7
8. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action (P-3). TDL-AST7-5.8
9. Disassemble engine block; clean and prepare components for inspection and reassembly (P-1). TDL-AST7-5.9
10. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action (P-2). TDL-AST7-5.10
11. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action (P-3). TDL-AST7-5.11
12. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action (P-2). TDL-AST7-5.12
13. Deglaze and clean cylinder walls (P-2). TDL-AST7-5.13
14. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action (P-3). TDL-AST7-5.14
15. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action (P-1). TDL-AST7-5.15
16. Inspect main and connecting rod bearings for damage and wear; determine necessary action (P-2). TDL-AST7-5.16
17. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action (P-3). TDL-AST7-5.17

18. Inspect and measure piston skirts and ring lands; determine necessary action (P-2). [TDL-AST7-5.18](#)
  19. Determine piston-to-bore clearance (P-2). [TDL-AST7-5.19](#)
  20. Inspect, measure, and install piston rings (P-2). [TDL-AST7-5.20](#)
  21. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time (P-2). [TDL-AST7-5.21](#)
  22. Assemble engine block (P-1). [TDL-AST7-5.22](#)
  23. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action (P-2). [TDL-AST7-5.23](#)
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**TDL-AST7-6. Perform hydraulic brake system service and repairs.** [TDL-AST7-6](#)

1. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine necessary action (P-2). [TDL-AST7-6.1](#)
2. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine necessary action (P-2). [TDL-AST7-6.2](#)
3. Demonstrate bleeding the electronic brake control system hydraulic circuits (P-1). [TDL-AST7-6.3](#)
4. Demonstrate testing, diagnosing, and servicing electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data) (P-3). [TDL-AST7-6.4](#)
5. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.) (P-3). [TDL-AST7-6.5](#)

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**TDL-AST7-7. Perform General Electrical Systems Service.** TDL-AST7-7

1. Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs (P-2). TDL-AST7-7.1
2. Repair CAN/BUS wiring harness (P-1). TDL-AST7-7.2
3. Diagnose (troubleshoot) radio static and weak, intermittent, or no radio reception; determine necessary action (P-3). TDL-AST7-7.3
4. Diagnose (troubleshoot) body electronic system circuits using a scan tool; determine necessary action (P-3). TDL-AST7-7.4
5. Diagnose the cause(s) of false, intermittent, or no operation of anti-theft systems (P-3). TDL-AST7-7.5
6. Describe the process for software transfers, software updates, or flash reprogramming on electronic modules (P-3). TDL-AST7-7.6

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**Automobile Service  
Technology 8 (47.438)**

**TDL-AST8-1. The following standard is included in all CTAE courses adopted for the Career Cluster/Pathways.** TDL-AST8-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AST8-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AST8-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AST8-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AST8-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AST8-1.5
6. Present a professional image through appearance, behavior and language. TDL-AST8-1.6

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**TDL-AST8-2. Identify and utilize safety procedures and proper tools** The tasks in this standard originate from the NATEF Required Supplemental Tasks. TDL-AST8-2

1. Identify general shop safety rules and procedures. TDL-AST8-2.1
2. Utilize safe procedures for handling of tools and equipment. TDL-AST8-2.2
3. Identify and use proper placement of floor jacks and jack stands. TDL-AST8-2.3
4. Identify and use proper procedures for safe lift operation. TDL-AST8-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-AST8-2.5
6. Identify and use marked safety areas. TDL-AST8-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment. TDL-AST8-2.7
8. Demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment. TDL-AST8-2.8
9. Identify the location and use of eye wash stations. TDL-AST8-2.9
10. Identify and use the location and use of eye wash stations. TDL-AST8-2.10
11. Identify the location of the posted evacuation routes. TDL-AST8-2.11
12. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-AST8-2.12
13. Identify and wear appropriate clothing for lab/shop activities. TDL-AST8-2.13
14. Demonstrate securing hair and jewelry for lab/shop activities. TDL-AST8-2.14
15. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-AST8-2.15
16. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.). TDL-AST8-2.16
17. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-AST8-2.17

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**TDL-AST8-3. Identify and utilize proper tools and equipment.** TDL-AST8-3

1. Identify tools and the proper usage in automotive applications. TDL-AST8-3.1
2. Identify and properly use standard and metric designation. TDL-AST8-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-AST8-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-AST8-3.4
5. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, dialcaliper). TDL-AST8-3.5

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**TDL-AST8-4. Identify and utilize vehicle service information.** TDL-AST8-4

1. Identify information needed and the service requested on a repair order. TDL-AST8-4.1
2. Identify purpose and demonstrate proper use of fender covers, mats. TDL-AST8-4.2
3. Demonstrate use of the three C's (concern, cause, and correction). TDL-AST8-4.3
4. Review vehicle service history. TDL-AST8-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-AST8-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-AST8-4.6

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**TDL-AST8-5. Demonstrate general engine service techniques.** TDL-AST8-5

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**TDL-AST8-6. Perform general automatic transmission and manual transaxle and differential service.** TDL-AST8-6

1. Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine necessary action (P-1). TDL-AST8-6.1
2. Diagnose noise and vibration concerns; determine necessary action (P-2). TDL-AST8-6.2
3. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information (P-1). TDL-AST8-6.3
4. Disassemble, clean, and inspect transmission/transaxle (P-2). TDL-AST8-6.4
5. Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, sleeves, retainers, brackets, check valves/balls, screens, spacers, and gaskets) (P-2). TDL-AST8-6.5
6. Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine necessary action. (P-2). TDL-AST8-6.6
7. Assemble transmission/transaxle (P-2). TDL-AST8-6.7
8. Inspect, measure, and reseal oil pump assembly and components (P-2). TDL-AST8-6.8
9. Measure transmission/transaxle end play or preload; determine necessary action (P-1). TDL-AST8-6.9
10. Inspect, measure, and replace thrust washers and bearings (P-2). TDL-AST8-6.10
11. Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surface areas, feed pipes, orifices, and check valves/balls (P-2). TDL-AST8-6.11
12. Inspect bushings; determine necessary action (P-2). TDL-AST8-6.12
13. Inspect and measure planetary gear assembly components; determine necessary action (P-2). TDL-AST8-6.13
14. Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action (P-2). TDL-AST8-6.14
15. Diagnose and inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action (P-2). TDL-AST8-6.15
16. Inspect, measure, repair, adjust or replace transaxle final drive components (P-2). TDL-AST8-6.16
17. Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates, bands and drums; determine necessary action (P-2). TDL-AST8-6.17
18. Measure clutch pack clearance; determine necessary action (P-1). TDL-AST8-6.18

19. Air test operation of clutch and servo assemblies (P-1). [TDL-AST8-6.19](#)
20. Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, retainers; determine necessary action (P-2). [TDL-AST8-6.20](#)
21. Diagnose noise concerns through the application of transmission/transaxle power-flow principles (P-2). [TDL-AST8-6.21](#)
22. Diagnose hard shifting and jumping out of gear concerns; determine necessary action (P-2). [TDL-AST8-6.22](#)
23. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action (P-3). [TDL-AST8-6.23](#)
24. Disassemble, inspect clean, and reassemble internal transmission/transaxle components (P-3). [TDL-AST8-6.24](#)
25. Diagnose noise and vibration concerns; determine necessary action (P-2). [TDL-AST8-6.25](#)
26. Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings (P-3). [TDL-AST8-6.26](#)
27. Measure and adjust drive pinion depth (P-3). [TDL-AST8-6.27](#)
28. Measure and adjust drive pinion bearing preload (P-3). [TDL-AST8-6.28](#)
29. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types) (P-3). [TDL-AST8-6.29](#)
30. Check ring and pinion tooth contact patterns; perform necessary action (P-3). [TDL-AST8-6.30](#)
31. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case (P-3). [TDL-AST8-6.31](#)
32. Reassemble and reinstall differential case assembly; measure run out; determine necessary action (P-3). [TDL-AST8-6.32](#)
33. Diagnose noise, slippage, and chatter concerns; determine necessary action (P-3). [TDL-AST8-6.33](#)
34. Measure rotating torque; determine necessary action (P-3). [TDL-AST8-6.34](#)
35. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action (P-26). [TDL-AST8-6.35](#)
36. Diagnose noise, vibration, and unusual steering concerns; determine necessary action (P-3). [TDL-AST8-6.36](#)
37. Diagnose, test, adjust, and replace electrical/electronic components of four-wheel drive systems (P-3). [TDL-AST8-6.37](#)
38. Disassemble, service, and reassemble transfer case and components (P-3). [TDL-AST8-6.38](#)

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**TDL-AST8-7. Prepare vehicle for general suspension and steering systems service.** TDL-AST8-7

1. Identify and interpret suspension and steering system concerns; determine necessary action (P-1). TDL-AST8-7.1
2. Identify hybrid vehicle power steering system electrical circuits and safety precautions (P-2). TDL-AST8-7.2

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**TDL-AST8-8. Perform hydraulic brake system service and repairs.** TDL-AST8-8

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**TDL-AST8-9. Perform general electrical systems service.** TDL-AST8-9

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**TDL-AST8-10. Demonstrate knowledge of A/C systems.** TDL-AST8-10

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**TDL-AST8-11. Analyze engine performance.** TDL-AST8-11

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**Automobile Service  
Technology Internship 1  
(47.439)**

**TDL-ASTI-1. Demonstrate employability skills required by business and industry. The following elements should be integrated throughout the content of this course.** TDL-ASTI-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-ASTI-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-ASTI-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-ASTI-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-ASTI-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-ASTI-1.5
6. Present a professional image through appearance, behavior and language. TDL-ASTI-1.6

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**TDL-ASTI-2. Demonstrate relevancy of academic and technical skills needed on the job, integrating work-based and school-based learning.** TDL-ASTI-2

1. Compose complete and accurate paragraphs that include information regarding symptoms, diagnosis results, and appropriate details when preparing warranty claims and information for inclusion on work orders. TDL-ASTI-2.1
2. Identify the specific cause of the described problem by generating conclusions based on known symptoms related to the problem. TDL-ASTI-2.2
3. Demonstrate an understanding of all federal, state, and local rules and regulations regarding environmental issues related to the work of the automobile technician. Use documentation such as government impact statements, media information, and general knowledge of pollution and waste management to correctly use and dispose of products that result from the performance of a repair task. TDL-ASTI-2.3

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**TDL-ASTI-3. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-ASTI-3

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-ASTI-3.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-ASTI-3.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-ASTI-3.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-ASTI-3.4
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**Automobile Service  
Technology Internship 2  
(47.44)**

**TDL-ASTI-1. Demonstrate employability skills required by business and industry. The following elements should be integrated throughout the content of this course. TDL-ASTI-1**

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-ASTI-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-ASTI-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-ASTI-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-ASTI-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-ASTI-1.5
6. Present a professional image through appearance, behavior and language. TDL-ASTI-1.6

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**TDL-ASTI-2. Demonstrate relevancy of academic and technical skills needed on the job, integrating work-based and school-based learning. TDL-ASTI-2**

1. Compose complete and accurate paragraphs that include information regarding symptoms, diagnosis results, and appropriate details when preparing warranty claims and information for inclusion on work orders. TDL-ASTI-2.1
2. Identify the specific cause of the described problem by generating conclusions based on known symptoms related to the problem. TDL-ASTI-2.2
3. Demonstrate an understanding of all federal, state, and local rules and regulations regarding environmental issues related to the work of the automobile technician. Use documentation such as government impact statements, media information, and general knowledge of pollution and waste management to correctly use and dispose of products that result from the performance of a repair task. TDL-ASTI-2.3

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**TDL-ASTI-3. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-ASTI-3

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-ASTI-3.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-ASTI-3.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-ASTI-3.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-ASTI-3.4

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**Automobile Service  
Technology Internship 3  
(47.441)**

**TDL-ASTI-1. Demonstrate employability skills required by business and industry. The following elements should be integrated throughout the content of this course.** TDL-ASTI-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-ASTI-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-ASTI-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-ASTI-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-ASTI-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-ASTI-1.5
6. Present a professional image through appearance, behavior and language. TDL-ASTI-1.6

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**TDL-ASTI-2. Demonstrate relevancy of academic and technical skills needed on the job, integrating work-based and school-based learning.** TDL-ASTI-2

1. Compose complete and accurate paragraphs that include information regarding symptoms, diagnosis results, and appropriate details when preparing warranty claims and information for inclusion on work orders. TDL-ASTI-2.1
2. Identify the specific cause of the described problem by generating conclusions based on known symptoms related to the problem. TDL-ASTI-2.2
3. Demonstrate an understanding of all federal, state, and local rules and regulations regarding environmental issues related to the work of the automobile technician. Use documentation such as government impact statements, media information, and general knowledge of pollution and waste management to correctly use and dispose of products that result from the performance of a repair task. TDL-ASTI-2.3

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**TDL-ASTI-3. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-ASTI-3

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-ASTI-3.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-ASTI-3.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-ASTI-3.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-ASTI-3.4
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## Fundamentals of Aerospace (47.46)

### **TDL-FA-1. Demonstrate employability skills required by business and industry.** TDL-FA-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-FA-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-FA-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-FA-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-FA-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-FA-1.5
6. Present a professional image through appearance, behavior and language. TDL-FA-1.6

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### **TDL-FA-2. Explain aspects of aviation history and interpret aviation regulations.** TDL-FA-2

1. Recognize that contributions in aerospace are made by both individuals and teams. TDL-FA-2.1
2. Recognize aerospace is a catalyst for technological advancements in multiple disciplines and industries (medical, technology, safety, transportation). TDL-FA-2.2
3. Summarize the evolution of aviation science. TDL-FA-2.3
4. List the significant aerospace regulatory agencies and state the purpose and significance of each. TDL-FA-2.4

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### **TDL-FA-3. Examine the various principles regarding flight.** TDL-FA-3

1. List and define the 4 forces of flight (force, thrust, drag, and lift). TDL-FA-3.1
2. Recognize the importance of Bernoulli's principle and Newton's laws of motion on the forces of flight. TDL-FA-3.2
3. Conduct scientific investigations that show forces acting on aircraft. TDL-FA-3.3
4. List and define the 3 axes of flight (longitudinal, lateral, and vertical). TDL-FA-3.4
5. Illustrate basic aircraft design principles (lighter than air, fixed wing, rotor craft, and space craft). TDL-FA-3.5

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**TDL-FA-4. Explore the various careers in the aerospace industry.** TDL-FA-4

1. Recognize at least four (4) general aerospace life cycle phases (engineering/design, manufacturing, operations, and maintenance). TDL-FA-4.1
2. Describe the research, development and testing processes used in aerospace industries. TDL-FA-4.2
3. List major aerospace employers in each life cycle phase (engineering/design, manufacturers, operations and maintenance) in the state and give examples of various jobs found at each. TDL-FA-4.3
4. List major job titles found in the flight operations area and describe their major duties. TDL-FA-4.4
5. List major job titles found in the aviation maintenance area and describe their major duties. TDL-FA-4.5
6. List major jobs and titles in the air field operations area and describe their major duties. TDL-FA-4.6

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**TDL-FA-5. Analyze the human factors that affect our work environments.** TDL-FA-5

1. Realize how important it is to mitigate human errors in the aerospace industry and investigate examples of how standardized processes and procedures minimize variance and human error. TDL-FA-5.1
2. Define the various parts of the SHELL model (software, hardware, environmental, liveware) and then describe how they interact. TDL-FA-5.2
3. Hypothesize how personal capabilities and behavior affect various parts of performance within the SHELL model (self-regulating system, reporting, and crew rest). TDL-FA-5.3
4. Understand that aircraft accidents are not a single factor event, but made up of many contributing causes. TDL-FA-5.4

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**TDL-FA-6. Explore the major aerospace technology areas.** TDL-FA-6

1. List various aerospace safety technologies and recognize events that brought them to fruition. TDL-FA-6.1
2. List various aerospace materials innovations and recognize events that brought them to fruition. TDL-FA-6.2
3. List various aerospace basic, radio, and advanced navigation techniques and tools and instances of when to use each. TDL-FA-6.3
4. List various forms of aerospace communications and the environments where each is typically used. TDL-FA-6.4

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**TDL-FA-7. Understand the basic aviation meteorology concepts.** TDL-FA-7

1. List and describe the basic atmospheric conditions affecting weather and flight conditions. TDL-FA-7.1
2. Describe the relationship between the sun and earth as it relates to seasons and air circulation. TDL-FA-7.2
3. List and compare aviation weather forecasting and weather services and other public weather services. TDL-FA-7.3

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**TDL-FA-8. Develop an understanding of aviation careers, describe the principal fields of specializations and identify associated career opportunities.** TDL-FA-8

1. Identify education requirements for aviation occupations and locations where programs of study are available. TDL-FA-8.1
2. Match aviation job titles with qualifications and responsibilities. TDL-FA-8.2
3. Participate in activities related to career interests. TDL-FA-8.3

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**TDL-FA-9. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** TDL-FA-9

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-FA-9.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-FA-9.2
  3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-FA-9.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-FA-9.4
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**Aviation Maintenance I  
(47.462)**

**TDL-AM1-1. Demonstrate employability skills required by business and industry.** TDL-AM1-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AM1-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AM1-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AM1-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AM1-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AM1-1.5
6. Present a professional image through appearance, behavior and language. TDL-AM1-1.6
7. Understand that there are distinct regulatory English language eligibility requirements in Title 14 of the Code of Federal Regulations (CFR); in part 61 for pilots and flight and ground instructors; part 63 for Flight Engineers and flight navigators; and part 65 for air traffic control (ATC) tower operators, aircraft dispatchers, mechanics, repairmen, and parachute riggers. In addition, the standards found in International Civil Aviation Organization (ICAO) Annex 1 require that certain Airman Certificates have an endorsement for English language proficiency in order for those airmen to act as required crew of an aircraft internationally. TDL-AM1-1.7

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**TDL-AM1-2. Perform algebraic operations relating to aviation.** TDL-AM1-2

1. Perform aviation exercises that include adding, subtracting, multiplying, and dividing positive whole numbers. TDL-AM1-2.1
2. Perform aviation exercises that include adding, subtracting, multiplying, and dividing signed numbers. TDL-AM1-2.2
3. Perform aviation exercises that include adding, subtracting, multiplying and dividing common fractions and decimals. TDL-AM1-2.3
4. Perform aviation exercises that include converting fractions to decimals and decimals to fractions. TDL-AM1-2.4
5. Perform aviation exercises that include basic algebraic manipulations. TDL-AM1-2.5

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**TDL-AM1-3. Extract roots and raise numbers to a given power relating to aviation.** TDL-AM1-3

1. Perform aviation exercises that include raising whole numbers, decimals, and fractions to a given power. TDL-AM1-3.1
2. Perform aviation exercises that include using powers of ten to express large numbers. TDL-AM1-3.2
3. Perform aviation exercises that include converting from base ten to base two and vice versa. TDL-AM1-3.3
4. Perform aviation exercises that include determining square roots. TDL-AM1-3.4

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**TDL-AM1-4. Calculate the area and volume of various geometrical shapes relating to aviation.** TDL-AM1-4

1. Perform aviation exercises that include computing various linear measurements. TDL-AM1-4.1
2. Apply formulas to determine the area of aircraft wings. TDL-AM1-4.2
3. Apply formulas to calculate volume in exercises relating to aviation. TDL-AM1-4.3
4. Calculate the volume of fuel tanks of an aircraft and express in gallons. TDL-AM1-4.4
5. Calculate the displacement of an aircraft engine. TDL-AM1-4.5

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**TDL-AM1-5. Compute ratio, proportion, and percentage problems relating to aviation.** TDL-AM1-5

1. Solve aviation exercises that include sample percentage problems. TDL-AM1-5.1
2. Solve aviation exercises that include converting percentages to a decimal or fraction. TDL-AM1-5.2
3. Perform aviation exercises that include common ratios and proportions. TDL-AM1-5.3
4. Solve aviation exercises that include computing compression ratios from specified volumes. TDL-AM1-5.4

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**TDL-AM1-6. Explore temperature and heat terminology.** TDL-AM1-6

1. Demonstrate and define heat terminology related to aviation. TDL-AM1-6.1
2. Demonstrate and determine aviation exercises related to temperature. TDL-AM1-6.2
3. Identify and describe methods of heat transfer. TDL-AM1-6.3

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**TDL-AM1-7. Calculate pressure, temperature, and volume of air mass relating to aviation.** TDL-AM1-7

1. Solve appropriate gas law problems related to aircraft cylinders. TDL-AM1-7.1
2. Discuss the effects of atmosphere on aircraft power plants, cabin atmosphere, aircraft structure, and aircraft performance. TDL-AM1-7.2
3. Apply general gas law to pressure, volume, and temperature changes. TDL-AM1-7.3

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**TDL-AM1-8. Understand basic aerodynamics and theory of flight principles.** TDL-AM1-8

1. Sketch an airfoil and diagram air flow patterns. TDL-AM1-8.1
2. Define Bernoulli's principle. TDL-AM1-8.2
3. Discuss the effects of air density and temperature changes on aircraft performance. TDL-AM1-8.3

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**TDL-AM1-9. Determine physical factors affecting engine output.** TDL-AM1-9

1. Describe the effects of air density on engine power. TDL-AM1-9.1
2. Define work as related to engine output. TDL-AM1-9.2
3. Define power related to engine output. TDL-AM1-9.3

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**TDL-AM1-10. Use the relationship of pressure, area, and force in aerospace applications.** TDL-AM1-10

1. Solve applicable hydraulic and pneumatic problems involving pressure, area, and force. TDL-AM1-10.1
2. Draw sketches of a simple hydraulic system. TDL-AM1-10.2

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**TDL-AM1-11. Understand and explain the origin of sound.** TDL-AM1-11

1. Identify and explain the nature of sound and frequency. TDL-AM1-11.1
2. Discuss machine numbers and decibel levels. TDL-AM1-11.2

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**TDL-AM1-12. Utilize principles of simple machines.** TDL-AM1-12

1. Demonstrate uses of simple machines. TDL-AM1-12.1

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**TDL-AM1-13. Understand and explain centrifugal and centripetal force.** TDL-AM1-13

1. Apply Newton's three laws to examples in aviation. TDL-AM1-13.1
2. Label a diagram to illustrate centrifugal and centripetal force. TDL-AM1-13.2

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**TDL-AM1-14. Read and interpret aircraft drawings.** TDL-AM1-14

1. Identify and interpret basic lines and symbols used in aircraft drawings and schematic diagrams. TDL-AM1-14.1
2. Interpret dimensions on aircraft drawings. TDL-AM1-14.2
3. Read, interpret, describe, and locate components on aircraft drawings. TDL-AM1-14.3
4. Make sketches and drawings of repairs and alterations. TDL-AM1-14.4
5. Read and interpret drawings to include scale, title block, and changes. TDL-AM1-14.5
6. Interpret installation diagrams, service bulletins, and engineering changes. TDL-AM1-14.6
7. Read and interpret manufacturers' charts and graphs. TDL-AM1-14.7

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**TDL-AM1-15. Calculate aircraft weight and balance.** TDL-AM1-15

1. Identify types and sources of information required to perform weight and balance procedures. TDL-AM1-15.1
2. Prepare an aircraft for weighing, weigh aircraft, and compute empty weight C.G. and useful load. TDL-AM1-15.2
3. Use FAA specifications and type data sheets to identify leveling and weighing information, identify useful load and empty center of gravity, and determine location of pilot passenger seats. TDL-AM1-15.3
4. Compute the effects of equipment changes on the empty weight, center of gravity, and useful load of an aircraft. TDL-AM1-15.4
5. Perform complete weight and balance check and record data. TDL-AM1-15.5
6. Solve a typical helicopter weight, load and balance problem. TDL-AM1-15.6
7. Analyze weight and balance records. TDL-AM1-15.7

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**TDL-AM1-16. Construct and manipulate fluid lines and fittings.** TDL-AM1-16

1. Demonstrate bending aluminum tubing using hand and tool methods. TDL-AM1-16.1
2. Demonstrate forming single and double flares on aluminum tubing. TDL-AM1-16.2
3. Demonstrate cutting and deburring tubing. TDL-AM1-16.3
4. Demonstrate performing file or sand tubing. TDL-AM1-16.4
5. Demonstrate forming a bead on different sizes and types of tubing. TDL-AM1-16.5
6. Recognize and report defects in metal tubing. TDL-AM1-16.6
7. Demonstrate repairing damaged aluminum line assembly using a union. TDL-AM1-16.7
8. Demonstrate reworking tubing. TDL-AM1-16.8
9. Identify and accurately select hose and fittings. TDL-AM1-16.9
10. Demonstrate fabricating and installing flexible hose. TDL-AM1-16.10
11. Demonstrate installing sections of tubing and inspect installation. TDL-AM1-16.11
12. Perform an operational check of system. TDL-AM1-16.12

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**TDL-AM1-17. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-AM1-17

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-AM1-17.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-AM1-17.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-AM1-17.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-AM1-17.4
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**Aviation Maintenance II  
(47.463)**

**TDL-AM2-1. Demonstrate employability skills required by business and industry.** TDL-AM2-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-AM2-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-AM2-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-AM2-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-AM2-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-AM2-1.5
6. Present a professional image through appearance, behavior and language. TDL-AM2-1.6
7. Understand that there are distinct regulatory English language eligibility requirements in Title 14 of the Code of Federal Regulations (CFR); in part 61 for pilots and flight and ground instructors; part 63 for Flight Engineers and flight navigators; and part 65 for air traffic control (ATC) tower operators, aircraft dispatchers, mechanics, repairmen, and parachute riggers. In addition, the standards found in International Civil Aviation Organization (ICAO) Annex 1 require that certain Airman Certificates have an endorsement for English language proficiency in order for those airmen to act as required crew of an aircraft internationally. TDL-AM2-1.7

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**TDL-AM2-2. Explore aircraft materials and perform inspection processes.** TDL-AM2-2

1. Identify and accurately select proper hand tools. TDL-AM2-2.1
2. Identify and accurately select aircraft hardware and materials. TDL-AM2-2.2
3. Install or remove different types of nuts, bolts, and fasteners. TDL-AM2-2.3
4. Identify and accurately select substitution fasteners. TDL-AM2-2.4
5. Identify types of nonferrous aircraft metals and describe applications for each one. TDL-AM2-2.5
6. Identify and explain steel alloys and their applications. TDL-AM2-2.6
7. Demonstrate how to safety a series of nuts, bolts, cannon plugs, and turnbuckles. TDL-AM2-2.7
8. Measure inside and outside diameters with micrometers. TDL-AM2-2.8
9. Measure the thickness of a thin sheet of steel or aluminum. TDL-AM2-2.9
10. Describe the relationship between hardness and tensile strength. TDL-AM2-2.10
11. Select the proper heat treating process for a specific application. TDL-AM2-2.11
12. Describe the different types of heat treating processes. TDL-AM2-2.12
13. Perform basic heat treatment. TDL-AM2-2.13
14. Explain the process of eddy current inspection. TDL-AM2-2.14
15. Perform an eddy current particle inspection. TDL-AM2-2.15
16. Explain the process of ultra sound. TDL-AM2-2.16
17. Perform an ultra sound particle inspection. TDL-AM2-2.17
18. Explain the process of magnetic particle inspection. TDL-AM2-2.18
19. Perform a magnetic particle inspection. TDL-AM2-2.19
20. Explain the principles of dye penetrant inspection. TDL-AM2-2.20
21. Perform a dye penetrant inspection and interpret the results. TDL-AM2-2.21
22. Explain the desirable characteristics of a completed weld. TDL-AM2-2.22
23. Inspect welded assemblies for defects. TDL-AM2-2.23
24. Check for metal fatigue. TDL-AM2-2.24
25. Identify and select appropriate nondestructive testing methods. TDL-AM2-2.25

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**TDL-AM2-3. Demonstrate an understanding of the practice aircraft ground operations and servicing procedures.** TDL-AM2-3

1. Identify and describe various grades of aviation gasoline and jet fuels. TDL-AM2-3.1
2. Describe the properties of aviation fuel. TDL-AM2-3.2
3. Demonstrate safety precautions around aircraft and engines. TDL-AM2-3.3
4. Select correct fuel for a specific aircraft. TDL-AM2-3.4
5. Demonstrate standing fire guard. TDL-AM2-3.5
6. Accurately measure fuel in tanks and add fuel to aircraft. TDL-AM2-3.6
7. Identify and describe types of aircraft fires. TDL-AM2-3.7
8. Select the appropriate fire extinguishing agent for a specific fire. TDL-AM2-3.8
9. Start, ground operate, move, service, and secure aircraft and identify typical ground operation hazards. TDL-AM2-3.9
10. Demonstrate starting aircraft engines. TDL-AM2-3.10
11. Operate engine through power range and shut down engine. TDL-AM2-3.11
12. Demonstrate performing a functional check on all systems. TDL-AM2-3.12
13. Identify and use the different types of ground support equipment. TDL-AM2-3.13
14. Demonstrate starting taxi, towing, parking, and directing traffic with hand signals. TDL-AM2-3.14
15. Prepare an aircraft for outside storage. TDL-AM2-3.15
16. Secure aircraft for outside storage using appropriate tie downs. TDL-AM2-3.16

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**TDL-AM2-4. Practice aircraft cleaning and corrosion control.** TDL-AM2-4

1. Identify and select cleaning materials. TDL-AM2-4.1
2. Identify hazards of using caustic cleaning agents. TDL-AM2-4.2
3. Demonstrate cleaning aircraft. TDL-AM2-4.3
4. Demonstrate cleaning of an aircraft tire. TDL-AM2-4.4
5. Demonstrate cleaning typical engine parts. TDL-AM2-4.5
6. Inspect and accurately identify different types of corrosion. TDL-AM2-4.6
7. Describe the forms of corrosion found on aircraft. TDL-AM2-4.7
8. List the corrosion prone areas on an aircraft. TDL-AM2-4.8
9. Accurately select materials, remove corrosion, and apply protective coating. TDL-AM2-4.9
10. Demonstrate removing rust from ferrous parts and apply protective finish. TDL-AM2-4.10

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**TDL-AM2-5. Calculate the relationship of voltage, current, and resistance in electrical circuits.** TDL-AM2-5

1. Demonstrate the relationship among current, voltage, and resistance. TDL-AM2-5.1
2. Measure voltage drops using a voltmeter. TDL-AM2-5.2
3. Compare voltage drops with current flow. TDL-AM2-5.3
4. Calculate and measure amperage. TDL-AM2-5.4
5. Measure resistance and check for continuity. TDL-AM2-5.5
6. Calculate and measure drop across resistors. TDL-AM2-5.6

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**TDL-AM2-6. Interpret electrical circuit diagrams.** TDL-AM2-6

1. Identify and interpret electrical symbols and their functions, including solid state devices and functions. TDL-AM2-6.1
2. Trace circuits in aircraft wiring diagrams. TDL-AM2-6.2
3. Identify electrical malfunctions by reference to circuit diagrams. TDL-AM2-6.3
4. Use circuit diagram to assist in troubleshooting. TDL-AM2-6.4

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**TDL-AM2-7. Observe voltage, current, resistance, and continuity.** TDL-AM2-7

1. Identify and explain the prefixes kilo-, milli-, micro-, meg-, and mega-. TDL-AM2-7.1
2. Demonstrate the use of direct current (DC) electrical instruments. TDL-AM2-7.2
3. Connect voltmeter and ammeter in circuits and obtain correct readings. TDL-AM2-7.3
4. Demonstrate the use of an ohmmeter to locate open, closed, and shorted circuits. TDL-AM2-7.4

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**TDL-AM2-8. Calculate electrical power of various devices.** TDL-AM2-8

1. Calculate and measure power requirements for various electrical devices in aircraft electrical systems. TDL-AM2-8.1
2. Calculate and measure electric power required to operate an electric motor given efficiency and load. TDL-AM2-8.2
3. Calculate and measure total electric power to be furnished by a generator for a specified airplane. TDL-AM2-8.3

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**TDL-AM2-9. Calculate capacitance and inductance.** TDL-AM2-9

1. Explain laws of magnetism, polarity, natural magnetism, relays, and solenoids. TDL-AM2-9.1
2. Discuss effects of current polarity, generator action, transformer action, and selfinduction. TDL-AM2-9.2
3. Describe self and mutual inductance and solve series and parallel circuits. TDL-AM2-9.3
4. Explain dielectric material, factors affecting capacitance, and voltage ratings. TDL-AM2-9.4
5. Explain alternating current (AC) and resistance, inductance and capacitance (RLC) circuits. TDL-AM2-9.5
6. Measure capacitance and inductance. TDL-AM2-9.6

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**TDL-AM2-10. Examine and service aircraft batteries.** TDL-AM2-10

1. Differentiate among types of batteries, capacity, and ratings. TDL-AM2-10.1
2. Identify characteristics of aircraft storage batteries. TDL-AM2-10.2
3. Perform inspection of an aircraft battery. TDL-AM2-10.3
4. Remove, inspect, clean, and install a battery. TDL-AM2-10.4

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**TDL-AM2-11. Explore solid state devices and their applications.** TDL-AM2-11

1. Identify and describe the properties of semiconductor materials. TDL-AM2-11.1
2. List properties of P-N junction diodes. TDL-AM2-11.2
3. Demonstrate the effect of forward and reverse bias on a diode. TDL-AM2-11.3
4. Describe the applications of different diodes. TDL-AM2-11.4
5. Read and describe solid state device symbols. TDL-AM2-11.5

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**TDL-AM2-12. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-AM2-12

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-AM2-12.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-AM2-12.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-AM2-12.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-AM2-12.4
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**Logistics Fundamentals  
(47.4701)**

**TDL-LF-1. Demonstrate employability skills required by business and industry.** TDL-LF-1

1. Communicate effectively through writing, speaking, listening, reading and interpersonal abilities. TDL-LF-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-LF-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-LF-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-LF-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply teamwork skills. TDL-LF-1.5
6. Present a professional image through appearance, behavior and language. TDL-LF-1.6

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**TDL-LF-2. Identify safety and health procedures utilized in the classroom/lab environment.** TDL-LF-2

1. Identify location of safety and first aid equipment. TDL-LF-2.1
2. Identify procedures for emergency situations. TDL-LF-2.2
3. Research and identify types of hazardous materials. TDL-LF-2.3
4. Identify procedures for handling hazardous and combustible materials (MSDS and OSHA). TDL-LF-2.4
5. Explain Right to Know. TDL-LF-2.5
6. Describe the Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), Nuclear Regulatory Commission (NRC), U.S. Department of Transportation (DOT), and Federal Aviation Administration (FAA). TDL-LF-2.6
7. Explain the characteristics of a safe, clean, and orderly work environment, including hazard analysis, correcting hazards, environmental inspections, effective reporting of incidents and accidents, and a well-designed workplace environment. TDL-LF-2.7
8. Describe proper personal protective equipment needed in the warehouse environment. TDL-LF-2.8
9. Read and interpret equipment operating instructions. TDL-LF-2.9

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**TDL-LF-3. Explain the role economics plays in logistics and supply chain management.** TDL-LF-3

1. Explain the concept and the components of a global economy. TDL-LF-3.1
2. Define wants, needs, exchanges, scarcity, economic costs, competition, price, and non-price competition. TDL-LF-3.2
3. Differentiate between the factors of production. TDL-LF-3.3
4. Define the Law of Supply and The Law of Demand. TDL-LF-3.4
5. Illustrate on a graph how supply and demand determine equilibrium price and quantity. TDL-LF-3.5

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**TDL-LF-4. Acquire an understanding of logistics and supply chain management.** TDL-LF-4

1. Discuss the history and evolution of logistics and supply chain management. TDL-LF-4.1
2. Define terms related to the logistics and supply chain industry, including logistics, supply chain management, goods, services, e-commerce, customer service, quality control, material handling, and information technology. TDL-LF-4.2
3. Categorize stakeholders in a typical supply chain. TDL-LF-4.3
4. Describe the role of Third Party Logistics (3PL) providers. TDL-LF-4.4
5. Describe the role of freight forwarders. TDL-LF-4.5
6. Understand barcodes and QR codes and their role in the supply chain. TDL-LF-4.6
7. Discuss package damage control and reason this is important in the supply chain. TDL-LF-4.7

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**TDL-LF-5. Investigate the motor carrier industry relating to logistics and supply chain management.** TDL-LF-5

1. Chart the history and development of the motor carrier industry. TDL-LF-5.1
2. Differentiate between for hire and private carriers. TDL-LF-5.2
3. Differentiate between truckload (TL) and less-than-truckload (LTL) carriers. TDL-LF-5.3
4. Create an organizational chart of motor carrier industry by class of carrier. TDL-LF-5.4
5. Discuss the types of equipment used in the motor carrier industry (tractors and trailers). TDL-LF-5.5
6. Research the cost of operating a tractor-trailer. TDL-LF-5.6
7. Explain the advantages and disadvantages of choosing a motor carrier to ship materials. TDL-LF-5.7
8. Relate the role of a third party logistics (3PL) provider to the motor carrier industry. TDL-LF-5.8
9. Discuss how technology is used in the motor carrier industry, including Automatic Vehicle Location, Computer Aided Routing and Dispatch, Onboard Computers, Diagnostic and Maintenance Support Systems, Automatic Vehicle/Equipment Identification, and Collision Warning Systems. TDL-LF-5.9
10. Investigate safety and compliance issues on the Federal Motor Carrier Safety Administration website. TDL-LF-5.10
11. Compare and contrast careers in the motor carrier industry, along with their education, training requirements, salary ranges, and job openings. TDL-LF-5.11

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**TDL-LF-6. Investigate the railroad industry relating to logistics and supply chain management.** TDL-LF-6

1. Chart the history and development of the railroad industry. TDL-LF-6.1
2. Differentiate between Class I and Class II railroads. TDL-LF-6.2
3. Explain the basic unit of measure of freight handling used by railroads. TDL-LF-6.3
4. Discuss the types of equipment (freight cars) used in the railroad industry. TDL-LF-6.4
5. Create a chart of the types of equipment used by the industry. TDL-LF-6.5
6. Explain the advantages and disadvantages of choosing a railroad to ship materials. TDL-LF-6.6
7. Discuss how technology is used in the railroad industry, including Advanced Train Control Systems, Rail Yard Control, Communications and Signaling, Customer Service and Radio Frequency Identification. TDL-LF-6.7
8. Compare and contrast careers in the railroad industry, along with their education, training requirements, salary ranges, and job openings. TDL-LF-6.8

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**TDL-LF-7. Investigate the airline industry relating to logistics and supply chain management.** TDL-LF-7

1. Chart the history and development of the airline industry as it relates to logistics and supply chain management. TDL-LF-7.1
2. Differentiate between types of carrier, including freight carriers, combination carriers, and integrators. TDL-LF-7.2
3. Describe the Unit Load Device as it related to the airline industry. TDL-LF-7.3
4. Compare and contrast cargo aircraft specifications. TDL-LF-7.4
5. Create a chart of the types of aircraft used in the airline industry. TDL-LF-7.5
6. Explain the advantages and disadvantages of choosing an airline to ship materials. TDL-LF-7.6
7. Compare and contrast careers in the airline industry, along with their education, training requirements, salary ranges, and job openings. TDL-LF-7.7

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**TDL-LF-8. Investigate the ocean carrier industry relating to logistics and supply chain management.** TDL-LF-8

1. Chart the history and development of the ocean carrier industry and the history of containerization as it relates to logistics and supply chain management. TDL-LF-8.1
2. Define the terms related to ocean carrier industry including place of receipt, port of load, port of discharge, place of final destination, bill of lading, letter of credit, terms of sale, tariff, stow plan, bay plan, stevedore, manifest, dock receipt. TDL-LF-8.2
3. Understand the difference between inland waterways and oceans and the importance of each to logistics and supply chain management. TDL-LF-8.3
4. Explain units of measure employed in the ocean carrier industry, including break bulk, wet bulk, dry bulk, rolling stock, containerized cargo, and less than container load. TDL-LF-8.4
5. Create a chart of the types of vessels used in the industry. TDL-LF-8.5
6. Explain the advantages and disadvantages of choosing ocean carriers to ship materials. TDL-LF-8.6
7. Compare and contrast careers in the ocean carrier industry, along with their education, training requirements, salary ranges, and job openings. TDL-LF-8.7

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**TDL-LF-9. Acquire an understanding of the importance of deep water ports to logistics and supply chain management.** TDL-LF-9

1. Understand the geography of the world by identifying the continents and mapping the various key ports of the world. TDL-LF-9.1
2. Chart the history of deep water ports in the United States. TDL-LF-9.2
3. Define the characteristics required to be a deep water port. TDL-LF-9.3
4. Compare and contrast the top four deep water ports in the United States. TDL-LF-9.4
5. Explain the TEU, FEU unit of measure. TDL-LF-9.5
6. Describe the different types of cranes used at deep water port terminals. TDL-LF-9.6
7. Describe the different types of ocean freight containers including open top containers, high cube containers, reefers, dry cargo containers, flat containers, and tank containers. TDL-LF-9.7
8. Create a diagram of a United States deep water port. TDL-LF-9.8

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**TDL-LF-10. Explore types of equipment used in warehousing to move, store, and control and protect products.** TDL-LF-10

1. Identify the primary types of hand-operated warehouse equipment. TDL-LF-10.1
2. Differentiate various industrial fork trucks and automated guided vehicles used in a warehouse. TDL-LF-10.2
3. Investigate requirements for fork truck certification. TDL-LF-10.3
4. Identify the various types of loading dock equipment. TDL-LF-10.4
5. Compare and contrast the various types of conveyors and conveyor systems used in a warehouse. TDL-LF-10.5
6. Diagram the parts of overhead handling equipment including hoist, bridge cranes, job cranes, and gantry cranes. TDL-LF-10.6
7. Analyze various types of storage racks and their ability to subject materials to a FIFO or LIFO method of handling. TDL-LF-10.7

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**TDL-LF-11. Acquire an understanding of the concept of warehousing and material handling logistics.** TDL-LF-11

1. Understand the role warehousing and distribution plays in the supply chain. TDL-LF-11.1
2. Identify receiving as the first function area of all warehousing and distribution facilities. TDL-LF-11.2
3. Analyze storage activities as the second functional area of all warehousing distribution facilities TDL-LF-11.3
4. Examine order picking as the third function area of all warehousing and distribution facilities. TDL-LF-11.4
5. Understand that inventory management is an essential component of all the functional areas of warehousing and distribution facilities. TDL-LF-11.5
6. Identify shipping as the fourth functional area of all warehousing and distribution facilities. TDL-LF-11.6
7. Examine ergonomics as a process to minimize the chance of injury on the job and improve productivity. TDL-LF-11.7
8. Understand the need for sustainability in all warehousing and distribution facilities. TDL-LF-11.8

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**TDL-LF-12. Examine how related student organizations are integral parts of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-LF-12

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-LF-12.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-LF-12.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-LF-12.3
4. Explore the local, state and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-LF-12.4

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**Logistics Operations  
(47.4711)**

**TDL-LO-1. Demonstrate employability skills required by business and industry.** TDL-LO-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-LO-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-LO-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-LO-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-LO-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply teamwork skills. TDL-LO-1.5
6. Present a professional image through appearance, behavior and language. TDL-LO-1.6

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**TDL-LO-2. Distinguish the essential components of global supply chain logistics and assess how these components affect company viability, profitability, and effectiveness.** TDL-LO-2

1. Examine and describe the global supply chain life cycle. TDL-LO-2.1
2. Describe the roles and responsibilities of working in supply chain logistics. TDL-LO-2.2
3. Research and interpret the impact of viability and profitability TDL-LO-2.3
4. Examine and illustrate cost effectiveness and productivity enhancements in supply chain logistics. TDL-LO-2.4

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**TDL-LO-3. Investigate the global logistics environment and interpret its impact on the environment.** TDL-LO-3

1. Research and interpret the security requirements in supply chain logistics. TDL-LO-3.1
2. Research and illustrate the environmental impact of logistics activities. TDL-LO-3.2
3. Examine and describe the physical layout of the logistics environment. TDL-LO-3.3

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**TDL-LO-4. Analyze equipment utilized in the material handling environment and apply concepts to select the correct equipment for specific jobs.** TDL-LO-4

1. Define the types of equipment used in materials handling to include manually operated equipment and mechanically operated equipment. TDL-LO-4.1
2. Differentiate between the types of industrial lift trucks. TDL-LO-4.2
3. Identify and describe various types of loading dock equipment. TDL-LO-4.3
4. Compare and contrast the various types of conveyor equipment used and their application in the material handling facility. TDL-LO-4.4
5. Explore and predict the use of automated systems in the logistics environment. TDL-LO-4.5

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**TDL-LO-5. Identify and explain principles and procedures used to maintain a safe logistics work environment.** TDL-LO-5

1. Differentiate between various federal organizations and the requirements placed on the logistics industry. TDL-LO-5.1
2. Demonstrate and describe maintaining a safe, clean, and orderly work environment. TDL-LO-5.2
3. Explore and classify preventative and emergency safety procedures. TDL-LO-5.3
4. Analyze basic safe material handling practices. TDL-LO-5.4
5. Examine and determine uses of the various types of personal protective equipment in different situations. TDL-LO-5.5
6. Evaluate the purpose of a safety check TDL-LO-5.6
7. Identify and explain the maintenance requirement for equipment. TDL-LO-5.7

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**TDL-LO-6. Analyze quality control improvement principles as they relate to global supply chain logistics and synthesize how control systems are implemented in global supply chain logistics.** TDL-LO-6

1. Define quality control and its importance in the logistics environment TDL-LO-6.1
2. Identify and classify key elements of quality. TDL-LO-6.2
3. Evaluate the costs associated with implementing a quality program. TDL-LO-6.3
4. Identify and analyze quality control systems including Six Sigma, Total Quality Management, Lean Concepts, and International Organization for Standardization (ISO). TDL-LO-6.4
5. Describe the purpose of quality audits and the various types of audits performed. TDL-LO-6.5

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**TDL-LO-7. Examine and summarize the importance of effective communications in the logistics community.** TDL-LO-7

1. Research and explain the importance of effective communication in supply chain logistics. TDL-LO-7.1
2. Research and define internal communication. TDL-LO-7.2
3. Research and describe external communication with customers and suppliers TDL-LO-7.3
4. Examine and summarize the communication process model. TDL-LO-7.4
5. Compare and contrast internal and external electronic communication. TDL-LO-7.5

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**TDL-LO-8. Demonstrate an understanding of the role teamwork might play in solving problems in the logistics environment.** TDL-LO-8

1. Research and classify the components of a high performance team. TDL-LO-8.1
2. Examine and describe the characteristics, roles, and responsibilities of an effective team member TDL-LO-8.2
3. Research and explain ways to set team goals- Self-Monitoring, Analysis and Reporting Technology (SMART). TDL-LO-8.3
4. Examine and interpret various strategies for resolving conflicts and solving problems. TDL-LO-8.4
5. Research and summarize the seven steps to solving problems. TDL-LO-8.5

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**TDL-LO-9. Describe technology that you might use to improve efficiency in supply chain logistics.** TDL-LO-9

1. Identify and describe the various computer programs and systems used in supply chain logistics TDL-LO-9.1
2. Research and critique the uses of computer programs and system software in supply chain logistics. TDL-LO-9.2
3. Summarize the systems for capturing supply chain logistics information. TDL-LO-9.3

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**TDL-LO-10. Utilize current and acceptable abbreviations and terminology related to proper communications within distribution, logistics, and supply chain management.** TDL-LO-10

1. Identify and properly use the following terms accurately in distribution, logistics, and supply chain management communications. a. Logistics b. Supply Chain Management c. 3PL (3rd Party Logistics Provider) d. Freight Forwarder e. Distribution Centers f. Quality Control g. Six Sigma h. LEAN i. Pick to Light j. Vertical Lift Module k. Automatic Storage and Retrieval System l. Order Picking m. Warehouse Management System n. Yard Management System o. Transportation Management System p. Barcodes q. Radio Frequency Identification TDL-LO-10.1

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**TDL-LO-11. Understand and apply terminology used in logistics and supply chain management.** TDL-LO-11

1. Define logistics terminology including: logistics, reverse logistics, origin, destination, import, export, export trading companies, general trading companies, customs house brokers, import duties, importer, exporter, customs, liner service, container ship, bulk carrier, tanker, cargo ship, roll-on/roll-off vessel, for hire, barge, bunker. TDL-LO-11.1
2. Define supply chain management terminology including: channel management, competitive strategy, customer relationship management, distribution channel, information technology, inventory, cycle times, facilities, performance measurement, quality programs, sourcing, manufacturer, supplier, retailer, modes of transportation, cross-dock distribution, supply-chain strategy. TDL-LO-11.2

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**TDL-LO-12. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** TDL-LO-12

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-LO-12.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, growth and development. TDL-LO-12.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-LO-12.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-LO-12.4
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**Materials Management  
(47.4721)**

**TDL-MM-1. Demonstrate employability skills required by business and industry.** TDL-MM-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-MM-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-MM-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-MM-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-MM-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-MM-1.5
6. Present a professional image through appearance, behavior and language. TDL-MM-1.6

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**TDL-MM-2. Describe the process of receiving products.** TDL-MM-2

1. Describe the essential activities of receiving. TDL-MM-2.1
2. Identify and describe the procedures for handling in-bound trucks. TDL-MM-2.2
3. Describe load and security conditions prior to unloading. TDL-MM-2.3
4. List and describe standard product receipt documents. TDL-MM-2.4
5. Describe procedures for checking and reporting inbound products during unloading. TDL-MM-2.5

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**TDL-MM-3. Construct knowledge related to proper product storage techniques based on product life, risk of damage, hazards, and weight and size.** TDL-MM-3

1. Describe methods of determining the destination and direction of unloaded products. TDL-MM-3.1
2. Illustrate the key issues affecting forms in which products are stored. TDL-MM-3.2
3. Describe the forms in which products are stored. TDL-MM-3.3
4. Discuss other methods of storage and retrieval. TDL-MM-3.4
5. Construct a diagram and describe how an automated storage and retrieval system operates. TDL-MM-3.5

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**TDL-MM-4. Synthesize knowledge of order processing in terms of picking processes and how they impact warehouse operations.** TDL-MM-4

1. Describe best practices in order cycle and procurement process, including information flow. TDL-MM-4.1
2. Explain pick ticket inspection. TDL-MM-4.2
3. Identify and explain processes for accurately pulling products from storage identified in pick ticket. TDL-MM-4.3
4. Explain how audits are conducted to ensure pulled products are as ordered. TDL-MM-4.4
5. Describe staging of pulled products for shipping. TDL-MM-4.5
6. Describe steps involved in developing a packing manifest. TDL-MM-4.6

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**TDL-MM-5. Develop a logical argument of various types of packaging materials best suited for different product size, weight, function and design for shipment.** TDL-MM-5

1. Identify and demonstrate selecting the most appropriate and current packing material to package products, when necessary. TDL-MM-5.1
2. Describe the selection of packaging tools best suited for handling and packaging products. TDL-MM-5.2
3. Explain typical steps to protect product from weather. TDL-MM-5.3
4. Describe process to ensure that outbound product counts are accurate and products are free from defects. TDL-MM-5.4
5. Describe process for verifying outbound product counts against customer orders. TDL-MM-5.5
6. Describe correct product labeling in accordance with domestic and international regulations and company policy. TDL-MM-5.6
7. Identify and explain the steps to verify that the right packages are securely loaded in the correct trailer. TDL-MM-5.7
8. Identify and explain the steps to ensure that packages are securely loaded into trailers and correctly distributed based on safe loading procedures. TDL-MM-5.8

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**TDL-MM-6. Hypothesize how inventory control affects overall operations.** TDL-MM-6

1. Describe fundamentals of inventory control. TDL-MM-6.1
2. List and explain the main inventory control systems. TDL-MM-6.2
3. Explain methods of accurate counting. TDL-MM-6.3
4. Describe methods for capturing logistics information. TDL-MM-6.4
5. Describe "reverse" logistics. TDL-MM-6.5

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**TDL-MM-7. Discuss safe handling of hazardous materials, including classification, regulations, specifications, and methods of shipping and routing of dangerous goods.** TDL-MM-7

1. Explain government regulations related to hazardous materials handling. TDL-MM-7.1
2. Describe safe work practices for unloading and loading hazardous materials. TDL-MM-7.2
3. Discuss government and other safe work practices for transfer and storage of hazardous materials. TDL-MM-7.3
4. Describe how hazardous materials are identified in shipping documentation. TDL-MM-7.4

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**TDL-MM-8. Discuss and analyze common transportation modes used to transport goods and cargo, including air, marine, rail, pipeline, and intermodal.** TDL-MM-8

1. Describe the modes of transportation and their advantages and disadvantages. TDL-MM-8.1
2. Describe the main considerations in determining the best mode. TDL-MM-8.2
3. Explain how to use the information on performance of the different modes for rapid decision making. TDL-MM-8.3
4. Illustrate examples of transportation documentation. TDL-MM-8.4

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**TDL-MM-9. Demonstrate understanding of concepts related to dispatch, routing, and tracking operations, and basic customs terminology and documentation.** TDL-MM-9

1. Explain shipping documentation. TDL-MM-9.1
2. Describe main factors related to vehicle routing. TDL-MM-9.2
3. Describe ways to track cargo within yard. TDL-MM-9.3
4. Describe ways to track cargo en route. TDL-MM-9.4
5. Describe key features of intermodal transportation. TDL-MM-9.5
6. Summarize basic customs terminology and documentation. TDL-MM-9.6

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**TDL-MM-10. Apply basic measurement and conversion techniques to handle and ship materials.** TDL-MM-10

1. Discuss and perform the proper procedures to apply the significance of weight of materials for both incoming and outgoing shipments. TDL-MM-10.1
2. Compare and contrast the three types of scales found in most warehouses. TDL-MM-10.2
3. Convert a given U.S. standard measurement to a global metric unit of measurement utilizing basic formulas for conversion. TDL-MM-10.3

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**TDL-MM-11. Utilize current and acceptable abbreviations and terminology related to proper communications within distribution, logistics, and supply chain management.** TDL-MM-11

1. Identify and properly use the following terms accurately in distribution, logistics, and supply chain management communications. TDL-MM-11.1

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**TDL-MM-12. Understand and apply terminology used in logistics and supply chain management.** TDL-MM-12

1. Define logistics terminology including: outsourcing, asset recovery, repayment terms, bill-of-lading, invoice, prepaid terms, charged back, tariffs, pricing, terms of sale, free-on board, freight claim, freight costs, manifest. TDL-MM-12.1
2. Define supply chain management terminology including: supply chain strategy, distribution network, motor carriers, railroads, airlines, ocean carriers, pipelines, cross-dock distribution, capacity management, capacity planning, capacity strategy, quality programs, demand forecasting, order fulfillment, procurement, salvage and scrap disposal. TDL-MM-12.2

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**TDL-MM-13. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects, and competitive events.** TDL-MM-13

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-MM-13.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, growth, and development. TDL-MM-13.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-MM-13.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-MM-13.4
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## Flight Operations I (47.488)

### **TDL-F01-1. Demonstrate employability skills required by business and industry.** TDL-F01-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-F01-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-F01-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-F01-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-F01-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-F01-1.5
6. Present a professional image through appearance, behavior and language. TDL-F01-1.6
7. Understand that there are distinct regulatory English language eligibility requirements in Title 14 of the Code of Federal Regulations (CFR); in part 61 for pilots and flight and ground instructors; part 63 for Flight Engineers and flight navigators; and part 65 for air traffic control (ATC) tower operators, aircraft dispatchers, mechanics, repairmen, and parachute riggers. In addition, the standards found in International Civil Aviation Organization (ICAO) Annex 1 require that certain Airman Certificates have an endorsement for English language proficiency in order for those airmen to act as required crew of an aircraft internationally. TDL-F01-1.7

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### **TDL-F01-2. Identify and explain climate and seasonal changes of the earth's atmosphere.** TDL-F01-2

1. Identify and explain the structure of the earth's layers of the atmosphere, and become knowledgeable of the history of the study of meteorology. TDL-F01-2.1

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### **TDL-F01-3. Demonstrate an understanding of the relationship between air pressure, temperature, and density.** TDL-F01-3

1. Identify and explain vertical airflow and atmospheric stability. TDL-F01-3.1
2. Demonstrating an understanding of the effects of moisture in the atmosphere. TDL-F01-3.2
3. Demonstrate an understanding of the relationship between cloud development and precipitation. TDL-F01-3.3

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**TDL-F01-4. Demonstrate knowledge of the airplane systems and components.** TDL-F01-4

1. Differentiate among class and category of aircraft. TDL-F01-4.1
2. Demonstrate knowledge of aircraft components. TDL-F01-4.2

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**TDL-F01-5. Operate and employ weather technology and terminology.** TDL-F01-5

1. Observe and record weather data using units of measurement (i.e., degrees, knots, miles per hour, etc.). TDL-F01-5.1
2. Operate and employ weather tools (i.e. thermometer, barometer, and hygrometer, etc.). TDL-F01-5.2
3. Demonstrate an understanding of weather symbols and weather coding. TDL-F01-5.3
4. Describe atmospheric conditions using appropriate terminology. TDL-F01-5.4

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**TDL-F01-6. Demonstrate an understanding of mid latitude weather patterns and systems.** TDL-F01-6

1. Demonstrate an understanding of the horizontal and vertical circulation of low and high pressure systems. TDL-F01-6.1
2. Identify air masses and monitor daily weather phenomena. TDL-F01-6.2
3. Use weather tools and units of measurement. TDL-F01-6.3
4. Employ meteorological terminology and coding procedures. TDL-F01-6.4
5. Demonstrate an understanding of synoptic weather structure. TDL-F01-6.5
6. Demonstrate an understanding of temperature, pressure & dew point. TDL-F01-6.6
7. Demonstrate an understanding of frontal systems. TDL-F01-6.7
8. Demonstrate an understanding of weather patterns. TDL-F01-6.8

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**TDL-F01-7. Identify and describe aviation weather hazards.** TDL-F01-7

1. Identify and describe convective weather activity threats such as wind shear, thunderstorms, and heavy rain. TDL-F01-7.1
2. Recognize and describe the danger of instability in atmospheric conditions such as freezing levels, turbulence, and significant precipitation. TDL-F01-7.2
3. Examine and describe the importance of visual flight rules (VFR) ceilings and minimum visibility requirements to avoid significant atmospheric threats. TDL-F01-7.3

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**TDL-F01-8. Demonstrate an understanding of the structure of the national airspace system.** TDL-F01-8

1. Identify and describe the intended use of different airways. TDL-F01-8.1
2. Describe the basic Visual and Instrument Flight Rules required for safe operation of aircraft. TDL-F01-8.2

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**TDL-F01-9. Demonstrate an understanding of the various roles of air traffic control in the airspace system.** TDL-F01-9

1. Identify and explain the differences in the responsibilities and duties of Air Traffic Controllers in TRACONS (Terminal Radar Approach Control) and ARTCC (Air Route Traffic Control Centers). TDL-F01-9.1
2. Recognize and describe information used by air traffic controllers to track aircraft and manage traffic flows. TDL-F01-9.2
3. Demonstrate an understanding of airspace classification. TDL-F01-9.3

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**TDL-F01-10. Demonstrate an understanding of basic aeronautical charts and their application to flight planning.** TDL-F01-10

1. Distinguish between different types of aeronautical charts and their intended uses. TDL-F01-10.1
2. Demonstrate the use of symbols, colors, and scale to interpret aeronautical charts. TDL-F01-10.2

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**TDL-F01-11. Demonstrate usage of standard aviation vocabulary, phraseology, and acronyms for communications.** TDL-F01-11

1. Exhibit competence in utilizing the International Phonetic Alphabet. TDL-F01-11.1
2. Utilize standardized identifiers for aircraft and airports. TDL-F01-11.2
3. Demonstrate an understanding of standardized lighting, light signals and markings used at airports. TDL-F01-11.3
4. Demonstrate use of proper protocol required for radio communications. TDL-F01-11.4

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**TDL-F01-12. Demonstrate and describe knowledge of airports.** TDL-F01-12

1. Demonstrate knowledge of the difference between controlled, uncontrolled and private airports. TDL-F01-12.1
2. Identify and explain traffic patterns. TDL-F01-12.2
3. Identify and describe marking and signs in the airport environment. TDL-F01-12.3
4. Identify and describe airport lighting systems. TDL-F01-12.4

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**TDL-F01-13. Explain the operation of Aircraft Power Plant & related systems and flight instruments and identify the components of the aircraft system.** TDL-F01-13

1. Identify and explain the use of aircraft engine systems. TDL-F01-13.1
2. Identify and explain the use of aircraft fuel and oil systems. TDL-F01-13.2
3. Identify and explain the use of aircraft cooling systems. TDL-F01-13.3
4. Explain the uses of different propellers in aircraft systems. TDL-F01-13.4
5. Identify and explain the use of aircraft electrical systems. TDL-F01-13.5

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**TDL-F01-14. Identify instruments and develop an understanding of their functions.** TDL-F01-14

1. Identify and explain the functions of all basic flight instruments. TDL-F01-14.1
  2. Identify and explain the purpose for each flight instrument. TDL-F01-14.2
  3. Identify and explain flight instrument usage. TDL-F01-14.3
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**Flight Operations II  
(47.489)**

**TDL-F02-1. Demonstrate employability skills required by business and industry.** TDL-F02-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-F02-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-F02-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-F02-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-F02-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-F02-1.5
6. Present a professional image through appearance, behavior and language. TDL-F02-1.6
7. Understand that there are distinct regulatory English language eligibility requirements in Title 14 of the Code of Federal Regulations (CFR); in part 61 for pilots and flight and ground instructors; part 63 for Flight Engineers and flight navigators; and part 65 for air traffic control (ATC) tower operators, aircraft dispatchers, mechanics, repairmen, and parachute riggers. In addition, the standards found in International Civil Aviation Organization (ICAO) Annex 1 require that certain Airman Certificates have an endorsement for English language proficiency in order for those airmen to act as required crew of an aircraft internationally. TDL-F02-1.7

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**TDL-F02-2. Demonstrate and apply knowledge of sources of flight information.** TDL-F02-2

1. Demonstrate knowledge of printed flight information. TDL-F02-2.1
2. Demonstrate knowledge of electronic sources of flight information. TDL-F02-2.2

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**TDL-F02-3. Apply sources of weather information to flight planning.** TDL-F02-3

1. Apply information related to preflight weather sources. TDL-F02-3.1
2. Apply information related to in-flight weather sources. TDL-F02-3.2
3. Demonstrate application of hazardous in-flight weather advisory systems. TDL-F02-3.3

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**TDL-F02-4. Demonstrate an understanding of aircraft performance and design.** TDL-F02-4

1. Demonstrate the ability to use performance charts to predict density altitude, surface wind components, take-off and landing distances, climb performance, and cruise power settings. TDL-F02-4.1
2. Identify the importance of weight and balance and demonstrate the application of the weight and balance principles with the use of loading graphs and charts. TDL-F02-4.2.
3. Demonstrate knowledge and usage of mechanical and electronic flight computers and flight computer applications. TDL-F02-4.3
4. Identify and apply information obtained from performance charts. TDL-F02-4.4
5. Accurately compute weight and balance. TDL-F02-4.5
6. Accurately complete computations on manual EGBs and electronic flight computers. TDL-F02-4.6

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**TDL-F02-5. Demonstrate competency in communication and flight information.** TDL-F02-5

1. Differentiate between different services for national aerospace system. TDL-F02-5.1
2. Differentiate between primary and secondary radar. TDL-F02-5.2
3. Demonstrate proficiency in radio procedures. TDL-F02-5.3
4. Demonstrate proficiency in applying sources of flight information. TDL-F02-5.4

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**TDL-F02-6. Demonstrate an understanding of aviation weather codes and terminology.** TDL-F02-6

1. Demonstrate an understanding of the METAR format for reporting weather information coding for weather observations, terminal forecasts, and weather advisories (i.e., pilot report (PIREPS), Airmen's Meteorological Information (AIRMETS), (SIGMETS) Significant Meteorological Information (SIGMETS), etc. TDL-F02-6.1
2. Interpret data from multiple weather data sources (commercial, government and military). TDL-F02-6.2
3. Access available meteorological resources to obtain weather data. TDL-F02-6.3

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**TDL-F02-7. Identify tools of basic, radio, and advanced navigation.** TDL-F02-7

1. Demonstrate proper use of landmarks to travel between points. TDL-F02-7.1
2. Apply mathematics to solve navigation problems. TDL-F02-7.2
3. Determine appropriate uses of pilotage and dead reckoning. TDL-F02-7.3
4. Distinguish among the different instruments used in radio and advanced technologies. TDL-F02-7.4

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**TDL-F02-8. Demonstrate an understanding of appropriate aviation measurements and calculations.** TDL-F02-8

1. Demonstrate the use of appropriate units of measure. TDL-F02-8.1
2. Apply units of latitude and longitude for geographic references accurately. TDL-F02-8.2
3. Demonstrate the accurate interpretation of the compass as a navigation tool. TDL-F02-8.3
4. Apply algebra and trigonometry to solve navigation problems. TDL-F02-8.4

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**TDL-F02-9. Incorporate navigation and communication tools to create a flight plan.** TDL-F02-9

1. Use required references for flight planning. TDL-F02-9.1
2. Incorporate current meteorological data. TDL-F02-9.2
3. Apply measurements and calculations to accurately plan and file a cross-country flight. TDL-F02-9.3

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**TDL-F02-10. Incorporate current weather information when creating a flight plan.** TDL-F02-10

1. Demonstrate the ability to incorporate available meteorological resources for flight planning. TDL-F02-10.1
2. Demonstrate following required procedures to file a flight plan. TDL-F02-10.2

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**TDL-F02-11. Apply techniques to analyze and forecast weather data.** TDL-F02-11

1. Analyze weather charts for surface and upper air data. TDL-F02-11.1
  - . Identify vorticity, divergence, and the jet stream. TDL-F02-11.2.
  - . Employ methods of forecasting. TDL-F02-11.3.
  - . Produce a forecast product. TDL-F02-11.4.

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**TDL-F02-12. Apply atmospheric dynamics to aeronautical components.** TDL-F02-12

1. Detect VFR (Visual Flight Rules), MFR (Marginal Flight Rules) and IFR (Instrument Flight Rules) weather conditions. TDL-F02-12.1
2. Interpret the relevance of pressure changes to indicated altimeter readings. TDL-F02-12.2
3. Identify wind direction and speed as it applies to flight planning, crosswind components, and aircraft performance. TDL-F02-12.3
4. Apply seasonal and geographical weather variations to flight characteristics and aircraft performance. TDL-F02-12.4

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**Unmanned Aircraft Systems (47.4891)**

**TDL-UAS-1. Demonstrate employability skills required by business and industry.** TDL-UAS-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-UAS-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-UAS-1.2
3. Exhibit critical thinking and problem-solving skills to locate, analyze and apply information in career planning and employment situations. TDL-UAS-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-UAS-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply teamwork skills. TDL-UAS-1.5
6. Present a professional image through appearance, behavior and language. TDL-UAS-1.6

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**TDL-UAS-2. Compare and contrast the types and uses of unmanned aircraft.** TDL-UAS-2

1. Distinguish the industrial classifications and nomenclature of unmanned aircraft lightweight/hobby determining utility of drones based on required mission parameters; weight categorization of drones. TDL-UAS-2.1
2. Understand the various current commercial uses of unmanned aircraft and potential future entrepreneurial possibilities (e.g., agriculture; public safety; photography; real estate; film; construction; military). TDL-UAS-2.2
3. Summarize the classifications and relevant specifications of unmanned aircraft for hobby, FAR part 107, industrial, and military. TDL-UAS-2.3

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**TDL-UAS-3. Formulate and develop a plan for adhering to unmanned flight ethics, safety and FAA requirements.** TDL-UAS-3

1. Explain the FAA rules and regulations for unmanned flight missions of all categories (e.g., personal, commercial). TDL-UAS-3.1
2. Describe and explain the registration requirements of unmanned aircraft. TDL-UAS-3.2
3. Differentiate the various types of airspace, authorizations, and waivers. TDL-UAS-3.3
4. Summarize the various types of communications with Air Traffic Control personnel before, during and after a flight mission. TDL-UAS-3.4
5. Explain the Visual Flight Rules for unmanned aircraft. TDL-UAS-3.5
6. Compare and contrast the implications of local and state unmanned aircraft laws. TDL-UAS-3.6
7. Cite evidence related to physiological factors affecting pilot performance with unmanned aircraft. TDL-UAS-3.7
8. Differentiate the ultimate impact of aeronautical decision making and judgement with unmanned aircraft. TDL-UAS-3.8
9. Explain and implement SMS (safety management system) impact on unmanned aircraft mission. TDL-UAS-3.9

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**TDL-UAS-4. Explain the steps and procedures involved in the pre-flight planning and checks.** TDL-UAS-4

1. Classify and record the mission and relevant flight requirements. TDL-UAS-4.1
2. Explain and make observations regarding a NOTAMs (Notices to Airmen) purpose, process, and importance. TDL-UAS-4.2
3. Identify patterns for unmanned flight missions in various weather conditions, and the effects of weather on small unmanned aircraft. TDL-UAS-4.3
4. Interpret weather reports for local or regional operation of unmanned flights dependent on size of unmanned drone and distance of flight. TDL-UAS-4.4
5. Understand the importance of a pre-flight inspection in accordance with the unmanned aircraft manufacturer's instruction (e.g. power system, communication, blade surfaces and rotors). TDL-UAS-4.5
6. Assess the impact of airspace, terrain, obstructions and population on the scheduled flight mission. TDL-UAS-4.6
7. Understand and verify the range requirements and limitations for specific unmanned aircraft on the scheduled flight mission. TDL-UAS-4.7

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**TDL-UAS-5. Describe and apply the payload regulations for use of small unmanned aircraft.** TDL-UAS-5

1. Identify patterns regarding how weight, stability, load factors and weight/balance specifications from manufacturer's specifications impact unmanned aircraft and missions. TDL-UAS-5.1
2. Collect observations and become familiar with larger unmanned aircraft capabilities and manufacturer's specifications for weight, stability, and load factors. TDL-UAS-5.2

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**TDL-UAS-6. Summarize, choose and utilize appropriate technologies as relatable to unmanned aircraft.** TDL-UAS-6

1. Compare and contrast various software and flight applications for unmanned aircraft related technology. TDL-UAS-6.1
2. Determine and identify appropriate technologies for unmanned aircraft missions. TDL-UAS-6.2

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**TDL-UAS-7. Construct results of unmanned aircraft flight using line-of-sight controls and remote instrumentation.** TDL-UAS-7

1. Demonstrate proficiency in manually operating unmanned aircraft in line of sight applications. TDL-UAS-7.1
2. Develop, upload, and execute a remote or autonomous unmanned aircraft mission profile. TDL-UAS-7.2

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**TDL-UAS-8. Formulate and explain technical flight and radio communication skills with aviators in the area of operation.** TDL-UAS-8

1. Demonstrate clear and concise communication with ground and tower personnel. TDL-UAS-8.1
2. Identify patterns for proficient communications and aviation phraseology including phonetic alphabet and basic aeronautical terms. TDL-UAS-8.2
3. Demonstrate basic knowledge of radio operations with ground and tower personnel, traffic advisory practices in uncontrolled airspace. TDL-UAS-8.3
4. Demonstrate familiarity and ability to communicate with pilots operating in the area of operation. TDL-UAS-8.4
5. Ability to communicate location, duration and mission objective. TDL-UAS-8.5
6. Summarize the process and steps for completing an incident report. TDL-UAS-8.6

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**TDL-UAS-9. Record and update accurate logs for unmanned flights and missions pre and post flight.** TDL-UAS-9

1. Record personal flight time and experience after each unmanned flight and mission. TDL-UAS-9.1
2. Summarize required steps and procedures for maintenance record keeping of each unmanned flight and mission. TDL-UAS-9.2
3. Distinguish the need for protecting, maintaining, and delivering mission data. TDL-UAS-9.3

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**TDL-UAS-10. Apply concepts necessary for unmanned flight mechanics and maintenance after each unmanned flight and mission.** TDL-UAS-10

1. Demonstrate competency in scheduled operator/pilot repair and maintenance. TDL-UAS-10.1
2. Review processes and troubleshooting steps to correct malfunctions of the unmanned aircraft system. TDL-UAS-10.2
3. Compare necessary procedures and steps to complete essential repairs and maintenance after each unmanned flight/mission. TDL-UAS-10.3
4. Complete and summarize procedures for unmanned aircraft (e.g. firmware updates, camera inspection, thermal issues and infra-red technology inspection, GPS). TDL-UAS-10.4

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**TDL-UAS-11. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-UAS-11

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-UAS-11.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-UAS-11.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-UAS-11.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-UAS-11.4
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## **Basic Maintenance and Light Repair I (47.5311)**

### **TDL-BMLR-1. Demonstrate employability skills required by business and industry.** TDL-BMLR-1

1. Communicate effectively through writing, speaking, listening, reading and interpersonal abilities. TDL-BMLR-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-BMLR-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-BMLR-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-BMLR-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply teamwork skills. TDL-BMLR-1.5
6. Present a professional image through appearance, behavior and language. TDL-BMLR-1.6

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**TDL-BMLR-2. Identify and utilize safety procedures and proper tools.** TDL-BMLR-2

1. Identify general shop safety rules and procedures. TDL-BMLR-2.1
2. Utilize safe procedures for handling of tools and equipment. TDL-BMLR-2.2
3. Identify and use proper placement of floor jacks and jack stands. TDL-BMLR-2.3
4. Identify and use proper procedures for safe left operation. TDL-BMLR-2.4
5. Utilize proper ventilation procedures for working within the lab/shop area. TDL-BMLR-2.5
6. Identify marked safety areas. TDL-BMLR-2.6
7. Identify the location and the types of fire extinguishers and other fire safety equipment: demonstrate knowledge of the procedures for using fire extinguishers and other safety equipment. TDL-BMLR-2.7
8. Identify the location and use of eye wash stations. TDL-BMLR-2.8
9. Identify the location of the posted evacuation routes. TDL-BMLR-2.9
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-BMLR-2.10
11. Identify and wear appropriate clothing for lab/shop activities. TDL-BMLR-2.11
12. Secure hair and jewelry for lab/shop activities. TDL-BMLR-2.12
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-BMLR-2.13
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc. TDL-BMLR-2.14
15. Locate and demonstrate knowledge of material safety data sheets (MSDS). TDL-BMLR-2.15

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**TDL-BMLR-3. Identify and utilize proper tools and equipment.** TDL-BMLR-3

1. Identify tools and their usage in automotive applications. TDL-BMLR-3.1
2. Identify standard and metric designations. TDL-BMLR-3.2
3. Demonstrate safe handling and use of appropriate tools. TDL-BMLR-3.3
4. Demonstrate proper cleaning, storage, and maintenance of tools and equipment. TDL-BMLR-3.4
5. Demonstrate proper use of precision measuring tools (e.g. micrometer, dial-indicator, and dial-caliper). TDL-BMLR-3.5

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**TDL-BMLR-4. Identify and utilize vehicle service information.** TDL-BMLR-4

1. Identify information needed and the service requested on a repair order. TDL-BMLR-4.1
2. Identify purpose and demonstrate proper use of fender covers and mats. TDL-BMLR-4.2
3. Demonstrate use of the three Cs (concern, cause, and correction). TDL-BMLR-4.3
4. Review vehicle service history. TDL-BMLR-4.4
5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-BMLR-4.5
6. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-BMLR-4.6

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**TDL-BMLR-5. Demonstrate general engine service techniques.** TDL-BMLR-5

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. TDL-BMLR-5.1
2. Verify operation of the instrument panel engine warning indicators. TDL-BMLR-5.2
3. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. TDL-BMLR-5.3
4. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. TDL-BMLR-5.4
5. Inspect, and test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air, as required. TDL-BMLR-5.5
6. Perform engine oil and filter change. TDL-BMLR-5.6

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**TDL-BMLR-6. Perform general automatic transmission and manual transaxle and differential service.** TDL-BMLR-6

1. Research applicable vehicle and service information, fluid type, vehicle service history, service precautions, and technical service bulletins. TDL-BMLR-6.1
2. Check fluid level in a transmission or a transaxle equipped with a dipstick. TDL-BMLR-6.2
3. Check fluid level in a transmission or a transaxle not equipped with a dipstick. TDL-BMLR-6.3
4. Check transmission fluid condition; check for leaks. TDL-BMLR-6.4
5. Inspect for leakage at external seals, gaskets, and bushings. TDL-BMLR-6.5
6. Drain and refill manual transmission/transaxle and final drive unit. TDL-BMLR-6.6
7. Check and adjust clutch master cylinder fluid level. TDL-BMLR-6.7
8. Check hydraulic clutch system for leaks. TDL-BMLR-6.8
9. Clean and inspect differential housing; check for leaks; inspect housing vent. TDL-BMLR-6.9
10. Check and adjust differential housing fluid level. TDL-BMLR-6.10
11. Drain and refill differential housing. TDL-BMLR-6.11
12. Check for leaks at drive assembly seals; check vents; check lube levels. TDL-BMLR-6.12

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**TDL-BMLR-7. Prepare vehicle for general suspension and steering systems service.** TDL-BMLR-7

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. TDL-BMLR-7.1
2. Determine proper power steering fluid type; inspect fluid level and condition. TDL-BMLR-7.2
3. Inspect for power steering fluid leakage; determine necessary action. TDL-BMLR-7.3
4. Inspect tire condition; identify tire wear patterns; check for correct size and application (load and speed ratings) and adjust air pressure; determine necessary action. TDL-BMLR-7.4
5. Rotate tires according to manufacturer's recommendations. TDL-BMLR-7.5
6. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly (static and dynamic). TDL-BMLR-7.6
7. Remove and properly re-install tire pressure monitoring system. TDL-BMLR-7.7
8. Inspect, dismount, and remount tire on wheel equipped with tire pressure monitoring system sensor. TDL-BMLR-7.8
9. Inspect tire and wheel assembly for air loss; perform necessary action. Explain patch/plug system. TDL-BMLR-7.9
10. Repair tire using internal patch. TDL-BMLR-7.10
11. Identify and test tire pressure monitoring systems (indirect and direct) for operation; verify operation of instrument panel lamps. TDL-BMLR-7.11

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**TDL-BMLR-8. Perform hydraulic brake system service and repairs.** TDL-BMLR-8

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. TDL-BMLR-8.1
2. Select, handle, store and fill brake fluids to proper level. TDL-BMLR-8.2
3. Install wheel and torque lug nuts. TDL-BMLR-8.3
4. Check parking brake cables and components for wear, binding and corrosion; clean, lubricate, adjust or replace, as needed. TDL-BMLR-8.4
5. Check operation of brake stop light system. TDL-BMLR-8.5

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**TDL-BMLR-9. Perform general electrical systems service.** TDL-BMLR-9

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. TDL-BMLR-9.1
2. Perform battery state-of-charge test; determine necessary action. TDL-BMLR-9.2
3. Confirm proper battery capacity for vehicle application; perform battery capacity test; determine necessary action. TDL-BMLR-9.3
4. Maintain or restore electronic memory functions. TDL-BMLR-9.4
5. Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps and hold-downs. TDL-BMLR-9.5
6. Perform slow/fast battery charge according to manufacturer's recommendations. TDL-BMLR-9.6
7. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply. TDL-BMLR-9.7
8. Identify high-voltage circuits of electricity or hybrid electric vehicle. TDL-BMLR-9.8
9. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights,/driving lights); replace as needed. TDL-BMLR-9.9
10. Verify operation of the instrument panel gauges and warning/light indicators; reset maintenance indicators. TDL-BMLR-9.10
11. Verify windshield wiper and washer operation; replace wiper blades. TDL-BMLR-9.11

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**TDL-BMLR-10. Demonstrate knowledge of A/C systems.** TDL-BMLR-10

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. TDL-BMLR-10.1
2. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action. TDL-BMLR-10.2

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**TDL-BMLR-11. Analyze engine performance.** TDL-BMLR-11

1. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. TDL-BMLR-11.1
2. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action. TDL-BMLR-11.2
3. Replace fuel filter(s). TDL-BMLR-11.3
4. Inspect, service, or replace air filters, filter housings, and intake ductwork. TDL-BMLR-11.4
5. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine necessary action. TDL-BMLR-11.5

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**TDL-BMLR-12. Develop an understanding of automotive careers, describing the principal fields of specializations and identifying associated career opportunities.** TDL-BMLR-12

1. Identify education requirements for automotive occupations and locations where programs of study are available. TDL-BMLR-12.1
2. Match automotive job titles with qualifications and responsibilities. TDL-BMLR-12.2
3. Participate in activities related to career interests. TDL-BMLR-12.3

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**TDL-BMLR-13. Examine how related student organizations are integral parts of career and technology education courses through leadership development, schools and community service projects, and competitive events.** TDL-BMLR-13

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA TDL-BMLR-13.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-BMLR-13.2
  3. Explore the impact and opportunities SkillsUSA can development to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-BMLR-13.3
  4. Explore the local, state and national opportunities available to students through participation in SkillsUSA, including, but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-BMLR-13.4
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**Basic Maintenance and  
Light Repair II (47.5311)**

**TDL-MLR2-1. Demonstrate employability skills required by business and industry.** TDL-MLR2-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-MLR2-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-MLR2-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-MLR2-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-MLR2-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply teamwork skills. TDL-MLR2-1.5
6. Present a professional image through appearance, behavior and language. TDL-MLR2-1.6

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**TDL-MLR2-2. Identify and accurately utilize safety procedures and proper tools** TDL-MLR2-2

1. Identify and demonstrate proper general shop safety rules and procedures. TDL-MLR2-2.1
2. Identify and demonstrate proper safe procedures for handling of tools and equipment. TDL-MLR2-2.2
3. Identify and demonstrate the proper procedures for placement of floor jacks and jack stands. TDL-MLR2-2.3
4. Identify and demonstrate the proper procedures for safe lift operation. TDL-MLR2-2.4
5. Identify and demonstrate the proper ventilation procedures for working within the lab/shop area. TDL-MLR2-2.5
6. Identify and demonstrate the proper procedures for marked safety areas. TDL-MLR2-2.6
7. Identify and describe the location and use of types of fire extinguishers and other fire safety equipment. TDL-MLR2-2.7
8. Identify and describe the location and use of eye wash stations. TDL-MLR2-2.8
9. Identify and describe the location of the posted evacuation routes. TDL-MLR2-2.9
10. Demonstrate the proper required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities. TDL-MLR2-2.10
11. Identify and demonstrate the proper use of appropriate clothing for lab/shop activities. TDL-MLR2-2.11
12. Demonstrate the proper method of securing hair and jewelry for lab/shop activities. TDL-MLR2-2.12
13. Demonstrate the proper use of safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits. TDL-MLR2-2.13
14. Demonstrate the proper use of safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.). TDL-MLR2-2.14
15. Locate and demonstrate the proper use of material safety data sheets (MSDS). TDL-MLR2-2.15

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**TDL-MLR2-3. Locate and demonstrate the proper use of material safety data sheets (MSDS).** TDL-MLR2-3

1. Identify and demonstrate proper use of tools practiced in automotive applications. TDL-MLR2-3.1
2. Identify and interpret the proper use of standard and metric designation. TDL-MLR2-3.2
4. Demonstrate the proper cleaning, storage, and maintenance of tools and equipment. TDL-MLR2-3.4
5. Demonstrate the proper use of precision measuring tools (e.g., micrometer, dialindicator, and dial-caliper). TDL-MLR2-3.5
3. Demonstrate the proper safe handling and use of appropriate tools. TDL-MLR2-3.3

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**TDL-MLR2-4. Identify and utilize vehicle service information.** TDL-MLR2-4

1. Demonstrate preparing a vehicle for service by identifying and using information needed, including the service requested on a repair order. TDL-MLR2-4.1
2. Illustrate the purpose and use of fender covers and mats. TDL-MLR2-4.2
3. Distinguish between proper use of the three C's (concern, cause, and correction) to prepare a vehicle for service. TDL-MLR2-4.3
4. Research and evaluate vehicle service history related to completing a work order that includes customer information, vehicle identifying information, customer concern, related service history, cause, and correction. TDL-MLR2-4.4
5. Identify and report how a vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.). TDL-MLR2-4.5

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**TDL-MLR2-5. Demonstrate general engine service techniques (Engine Repair General)** TDL-MLR2-5

1. Demonstrate the proper installation of engine covers using gaskets, seals, and sealers, as required. [NATEF I-A-4] TDL-MLR2-5.1
2. Demonstrate the proper methods required in common fastener and thread repair performance, including removing a broken bolt, restoring internal and external threads, and repairing internal threads with thread insert. [NATEF I-A-6] TDL-MLR2-5.2
3. Inspect and determine the necessary action required to perform cooling system pressure and dye tests to identify leaks, check coolant condition and level; and test the radiator, pressure cap, coolant recovery tank, and heater core. [NATEF O-C-1] TDL-MLR2-5.3
4. Demonstrate the proper method of removal, inspection and replacement of a thermostat and gasket/seal. [NATEF I-C-E] TDL-MLR2-5.4

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**TDL-MLR2-6. Apply concepts to perform general automatic transmission & manual transaxle & differential service.** TDL-MLR2-6

1. Apply concepts learned to properly inspect, replace, and align powertrain mounts for an in-vehicle automatic transmission/transaxle. [NATEF II-B-3] TDL-MLR2-6.1
2. Apply concepts learned to drain and replace in-vehicle automatic transmission/transaxle fluid and filter(s). [NATEF II-B-4] TDL-MLR2-6.2

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**TDL-MLR2-7. Apply concepts to prepare a vehicle for general suspension and steering systems service.** TDL-MLR2-7

1. Identify and perform a proper inspection of rack and pinion steering gear inner tie rod ends (sockets) and bellows boots for suspension and steering systems and related suspension and steering service. [NATEF VI-B-1] TDL-MLR2-7.1
2. Identify and perform the proper removal, inspection, replacement, and adjustment of a power steering pump drive belt. [NATEF IV-B-5] TDL-MLR2-7.2
3. Identify and perform a proper inspection of a pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper. [NATEF IV-B-7] TDL-MLR2-7.3
4. Identify and perform a proper inspection of tie rod ends (sockets), tie rod sleeves, and clamps. [NATEF IV-B-8] TDL-MLR2-7.4
5. Identify and perform a proper inspection of upper and lower control arms, bushings, and shafts. [NATEF IV-B-9] TDL-MLR2-7.5
6. Identify and perform a proper inspection and replacement of rebound and jounce bumpers. [NATEF IV-B-10] TDL-MLR2-7.6
7. Identify and properly inspect track bar, strut rods/radius arms, and related mounts and bushings. [NATEF IV-B-11] TDL-MLR2-7.7
8. Identify and perform a proper inspection of upper and lower ball joints (with or without wear indicators). [NATEF IV-B-12] TDL-MLR2-7.8
9. Identify and perform a proper inspection of suspension system coil springs and spring insulators (silencers). [NATEF IV-B-13] TDL-MLR2-7.9
10. Identify and perform a proper inspection and replacement of front stabilizer bar (sway bar) bushings, brackets, and links. [NATEF IV-B-15] TDL-MLR2-7.10
11. Identify and perform a proper inspection of rear suspension system lateral links/arms (track bars), control (trailing) arms. [NATEF IV-B-18] TDL-MLR2-7.11
12. Identify and perform a proper inspection, removal, and replacement of shock absorbers; inspect mounts and bushings. [NATEF IV-B-20] TDL-MLR2-7.12
13. Identify and describe the proper function of the power steering pressure switch. [NATEF IV-B-23] TDL-MLR2-7.13

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**TDL-MLR2-8. Perform hydraulic brake system service and repairs. TDL-MLR2-8**

1. Describe the proper procedure and perform a road test to check brake system operation, including an anti-lock brake system. [NATEF V-B-2] **TDL-MLR2-8.1**
2. Demonstrate and perform the proper procedure in checking the master cylinder for external leaks and proper operation. [NATEF B-B-2] **TDL-MLR2-8.2**
3. Determine the necessary action required after inspecting brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, loose fittings and supports. **TDL-MLR2-8.3**
4. Identify, explain, and describe components of the brake warning light system. [NATEF V-B-5] **TDL-MLR2-8.4**
5. Identify, explain, and perform the proper procedure to Bleed and/or flush the brake systems. [NATEF V-B-6] **TDL-MLR2-8.5**
6. Identify, explain, and perform the proper procedure to test brake fluid for contamination. [NATEF IV-B-7] **TDL-MLR2-8.6**
7. Determine the necessary action required after removing, cleaning, inspecting, and measuring brake drum diameter. [NATEF IV-C-3] **TDL-MLR2-8.7**
8. Identify, explain, and perform the proper procedure to refinish the brake drum and measure final drum diameter and compare with specifications. [NATEF IV-C-2] **TDL-MLR2-8.8**
9. Identify, explain and perform the proper procedure to lubricate and reassemble after removing, cleaning, and inspect brake shoes, springs, pins, clips, levers, adjusters/self adjusters, and other related brake hardware, backing support plates. [NATEF IV-C-3] **TDL-MLR2-8.9**
10. Explain and perform the proper procedure to remove and replace wheel cylinders for leaks and proper operation. [NATEF V-C-4] **TDL-MLR2-8.10**
11. Explain and perform the proper procedure to pre-adjust brake shoes and parking brake, install brake drums or drum/hub assemblies and wheel bearings, and conduct final checks and adjustments. [NATEF V-C-5] **TDL-MLR2-8.11**
12. Determine the proper procedure required for disc brakes after removing and cleaning caliper assembly and inspecting for leaks and damage/wear to the caliper housing. [NATEF V-D-1] **TDL-MLR2-8.12**
13. Determine the proper procedure required after cleaning and inspecting the caliper mounting and slides/pins for proper operation, wear, and damage. [NATEF V-D-2] **TDL-MLR2-8.13**
14. Determine the proper procedure required after removing, inspecting, and replacing pads and retaining hardware. [NATEF V-D-3] **TDL-MLR2-8.14**

15. Explain and determine the necessary action required to lubricate and reinstall caliper, pads, and related hardware; seat pads and inspect for leaks. [NATEF V-D-4] [TDL-MLR2-8.15](#)
16. Explain and determine necessary action after cleaning and inspecting the rotor, measuring rotor thickness, variation, and lateral run out. [NATEF V-D-5] [TDL-MLR2-8.16](#)
17. Explain and determine the proper procedure to remove and reinstall rotor. [NATEF V-D-6] [TDL-MLR2-8.17](#)
18. Compare with specifications after refinishing the rotor on the vehicle and measuring the final rotor thickness. [NATEF V-D-7] [TDL-MLR2-8.18](#)
19. Compare with specifications after refinishing the rotor off vehicle and measuring the final rotor thickness. [NATEF V-D-8] [TDL-MLR2-8.19](#)
20. Explain and perform the proper procedure to retract and re-adjust caliper piston on an integral parking brake system. [NATEF V-D-8] [TDL-MLR2-8.20](#)
21. Determine the necessary action required after checking the brake pad wear indicator. [NATEF V-D-10] [TDL-MLR2-8.21](#)
22. Describe the importance of operating the vehicle to burnish/break-in replacement brake pads according to the manufacturer's recommendations. [NATEF V-D-11] [TDL-MLR2-8.22](#)
23. Explain and perform the proper procedure to check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster. [NATEF V-E-2] [TDL-MLR2-8.23](#)
24. Explain and perform the proper procedure to remove, clean, inspect, repack, install wheel bearings, as well as replace seals, install hub and adjust bearings. [NATEF V-F-3] [TDL-MLR2-8.24](#)
25. Explain and perform the proper procedure to clean, lubricate and adjust or replace after checking the parking brake cables and components for wear, binding, and corrosion. [NATEF V-F-5] [TDL-MLR2-8.25](#)
26. Explain and perform the proper procedure to replace the wheel bearing and race. [NATEF V-F-5] [TDL-MLR2-8.26](#)

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**TDL-MLR2-9. Perform general electrical systems service** TDL-MLR2-9

1. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law). [NATEF VI-A-2] TDL-MLR2-9.1
2. Determine necessary action after inspecting and testing fusible links, circuit breakers, and fuses. [NATEF VI-A-9] TDL-MLR2-9.2
3. Explain and perform the proper procedure to solder repair of electric wiring. [NATEF VI-A-10] TDL-MLR2-9.3
4. Explain and perform proper identification of electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting the vehicle battery. [NATEF VI-B-8] TDL-MLR2-9.4
5. Determine and perform the necessary action required after performing the starter current draw test. [NATEF VI-C-1] TDL-MLR2-9.5
6. Determine necessary action after performing the starter circuit voltage drop tests. [NATEF VI-C-2] TDL-MLR2-9.6
7. Determine necessary action after performing a charging system output test. [NATEF VI-D-1] TDL-MLR2-9.7
8. Check pulley and belt alignment and tensioners for wear after inspecting, adjusting, or replacing the generator (alternator) drive belts. [NATEF VI-D-2] TDL-MLR2-9.8
9. Determine necessary action after performing a charging circuit voltage drop test. [NATEF VI-D-4] TDL-MLR2-9.9
10. Disable and enable airbag system for vehicle service and verify the indicator lamp operation. [NATEF F-1] TDL-MLR2-9.10

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**TDL-MLR2-10. Demonstrate knowledge of air conditioning systems.** TDL-MLR2-10

1. Determine necessary action after inspecting the air conditioning condenser for airflow restrictions. [NATEF VII-B-3] TDL-MLR2-10.1

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**TDL-MLR2-11. Perform fuel, air induction, and exhaust systems service and repair** TDL-MLR2-11

1. Determine the need to repair or replace after inspecting the condition of the exhaust system hangers, brackets, clamps, and heat shields. [NATEF VIII-C-4] TDL-MLR2-11.1
2. Check and refill the diesel exhaust fluid. [NATEF VIII-C-5] TDL-MLR2-11.2

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**TDL-MLR2-12. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-MLR2-12

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-MLR2-12.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-MLR2-12.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-MLR2-12.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including, but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-MLR2-12.4

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**Introduction to Collision Repair (47.565)**

**TDL-ICR-1. Demonstrate employability skills required by business and industry.** TDL-ICR-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-ICR-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-ICR-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-ICR-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-ICR-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-ICR-1.5
6. Present a professional image through appearance, behavior and language. TDL-ICR-1.6

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**TDL-ICR-2. Comply with personal and environmental safety practices associated with clothing and the use of gloves; respiratory protection; eye protection; hand tools; power tools; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and environmental regulations. These safety requirements must be strictly enforced for every task in painting and refinishing.** TDL-ICR-2

1. Identify and take necessary precautions with hazardous operations and materials according to federal, state and local regulations. TDL-ICR-2.1
2. Identify safety and personal health hazards according to OSHA guidelines and the "Right to Know" law. TDL-ICR-2.2
3. Inspect spray environments to ensure compliance with federal, state, and local regulations, and for safety and cleanliness hazards. TDL-ICR-2.3
4. Select and use the NIOSH-approved cartridge respirator. Inspect conditions and ensure fit and operation. Perform proper maintenance in accordance with OSHA regulations. TDL-ICR-2.4
5. Select and use the NIOSH-approved (fresh air make-up system). Perform proper maintenance in accordance with OSHA regulations. TDL-ICR-2.5
6. Select and use proper personal safety equipment for surface preparation, spray gun and related equipment operation, paint mixing, matching and application, paint defects and detailing (gloves, suits, hoods, eye and ear protection, etc.). TDL-ICR-2.6

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**TDL-ICR-3. Explore the different areas of the collision repair industry and understand what skills and knowledge are needed to be successful in each area of collision repair.** TDL-ICR-3

1. Compare each career pathway in the collision repair field. TDL-ICR-3.1
2. Research and report on one area of the collision repair field. TDL-ICR-3.2

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**TDL-ICR-4. Identify and correctly use power tools and hand tools used in collision repair.** TDL-ICR-4

1. Identify, use, and maintain common hand tools in the collision repair shop. TDL-ICR-4.1
2. Identify, use, and maintain common power tools in the collision repair shop. TDL-ICR-4.2

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**TDL-ICR-5. Learn basic metal repair techniques.** TDL-ICR-5

1. Distinguish between steel and aluminum. TDL-ICR-5.1
2. Demonstrate the ability to rough out a dent in a steel panel with a hammer and dolly. TDL-ICR-5.2
3. Demonstrate the ability to metal finish a dent in a steel panel with a hammer and dolly. TDL-ICR-5.3
4. Demonstrate the ability to remove a dent from a steel panel with a weld on dent puller. TDL-ICR-5.4
5. Demonstrate the ability to mix, apply, and block sand body filler to level. TDL-ICR-5.5
6. Demonstrate the ability to mix, apply, and block sand primer surfaces. TDL-ICR-5.6
7. Demonstrate safe work habits at all times and follow all classroom safety rules. TDL-ICR-5.7

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**TDL-ICR-6. Identify the most common types of plastic used in automotive construction and perform simple repairs using these materials.** TDL-ICR-6

1. Distinguish between the common types of plastic. TDL-ICR-6.1
2. Properly repair dents, gouges, and cuts in plastic panels using various methods. TDL-ICR-6.2
3. Demonstrate safe work habits at all times and follow all classroom safety rules. TDL-ICR-6.3

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**TDL-ICR-7. Identify the types of vehicle construction and know the advantages and disadvantages of each.** TDL-ICR-7

1. Distinguish between body over frame construction and uni-body construction. TDL-ICR-7.1
2. Discuss the advantages and disadvantages of body over frame and uni-body construction. TDL-ICR-7.2
3. Identify the parts of each type of vehicle construction. TDL-ICR-7.3
4. Discuss how each type of vehicle construction reacts in a collision and differences in repair techniques due to the type of construction. TDL-ICR-7.4

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**TDL-ICR-8. Identify and explain the differences in the types of material used in the automotive refinish industry, as well as demonstrate basic spray techniques.** TDL-ICR-8

1. Distinguish the difference in single stage and basecoat clear coat paint systems. TDL-ICR-8.1
2. Demonstrate the ability to mix and spray both single stage and basecoat clear coat paint systems. TDL-ICR-8.2

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**TDL-ICR-9. Read and write simple hand-written and computer-generated repair estimates.** TDL-ICR-9

1. Demonstrate the process of information gathering. TDL-ICR-9.1
2. Demonstrate the process of inspection. TDL-ICR-9.2
3. Process the inspection results with known information and formulate a repair estimate. TDL-ICR-9.3

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**TDL-ICR-10. Develop an understanding of automotive careers; describe the principal fields of specializations; and identify associated career opportunities.** TDL-ICR-10

1. Identify education requirements for automotive occupations and locations where programs of study are available. TDL-ICR-10.1
2. Match automotive job titles with qualifications and responsibilities. TDL-ICR-10.2
3. Participate in activities related to career interests. TDL-ICR-10.3

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**TDL-ICR-11. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects and competitive events.** TDL-ICR-11

1. Explain the purpose, mission, objectives, motto, colors, official dress, and other distinguishing characteristics of SkillsUSA. TDL-ICR-11.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community services, as well as professional growth and development. TDL-ICR-11.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-ICR-11.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-ICR-11.4
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## Painting and Refinishing I (47.566)

### **TDL-PR1-1. Demonstrate employability skills required by business and industry.** TDL-PR1-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-PR1-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-PR1-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-PR1-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-PR1-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-PR1-1.5
6. Present a professional image through appearance, behavior and language. TDL-PR1-1.6

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### **TDL-PR1-2. Comply with personal and environmental safety practices in accordance with local, state, and environmental regulations.** TDL-PR1-2

1. Identify and take necessary precautions with hazardous operations and materials according to federal state and local regulations. TDL-PR1-2.1
2. Identify and explain safety and personal health hazards according to OSHA guidelines and the "Right to Know" Law. TDL-PR1-2.2
3. Inspect spray environments to ensure compliance with federal, state, and local regulations, and for safety and cleanliness hazards. TDL-PR1-2.3
4. Select and use the National Institute for Occupational Safety and Health (NIOSH) approved cartridge respirator. Inspect condition and ensure fit and operation. Perform proper maintenance in accordance with OSHA regulations. TDL-PR1-2.4
5. Select and use the NIOSH approved fresh air make-up system. TDL-PR1-2.5
6. Perform proper maintenance in accordance to Occupational Safety and Health Administration (OSHA) regulations. TDL-PR1-2.6
7. Select and use the proper personal safety equipment for surface preparation, spray gun and related equipment operation, paint mixing, matching and application, paint defects and detailing (gloves, suits, hoods, eye and ear protection, etc.). TDL-PR1-2.7

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**TDL-PR1-3. Examine and practice various vehicle surface preparations.** TDL-PR1-3

1. Inspect, remove, store and replace exterior trim and components necessary for proper surface preparation. TDL-PR1-3.1
2. Identify and explain soaps and cleaners used for various car parts. TDL-PR1-3.2
3. Perform soap and water wash of entire vehicle using appropriate cleaner to remove contaminants. TDL-PR1-3.3
4. Inspect and explain substrate, type of finish, surface condition, and film thickness. TDL-PR1-3.4
5. Develop and document a plan for refinishing using a total product system. TDL-PR1-3.5
6. Demonstrate stripping paint to bare metal substrate (paint removal). TDL-PR1-3.6
7. Identify and explain types of sand paper, proper grits for various finishes, and types of backing pads. TDL-PR1-3.7
8. Identify and describe dry or wet sand areas to be finished. TDL-PR1-3.8
9. Identify and describe featheredge damaged areas to be refinished. TDL-PR1-3.9
10. Apply suitable metal treatment or primer in accordance with total product systems. TDL-PR1-3.10
11. Demonstrate masking and protecting other areas that will not be refinished. TDL-PR1-3.11
12. Mix primer, primer surfacer or primer sealer. TDL-PR1-3.12
13. Apply primer onto surface or repaired area. TDL-PR1-3.13
14. Identify and explain complimentary color or shade of undercoat to improve coverage. TDL-PR1-3.14
15. Apply two component finishing filler to mirror surface imperfections. TDL-PR1-3.15
16. Identify and explain block sand area to which primer-surfacer has been applied. TDL-PR1-3.16
17. Identify and explain dry or wet sand areas to which primer-surfacer has been applied. TDL-PR1-3.17
18. Identify and explain dry sand areas to which two-component finishing filler has been applied. TDL-PR1-3.18
19. Remove dust from area to be refinished, including cracks or moldings of adjacent areas. TDL-PR1-3.19
20. Clean area to be refinished using a final cleaning solution. TDL-PR1-3.20
21. Remove, with tack rag, any dust or lint particles from the area to be refinished. TDL-PR1-3.21

22. Apply suitable sealer to the area being refinished. [TDL-PR1-3.22](#)
23. Demonstrate scuffing sand area to remove imperfections from a sealer. [TDL-PR1-3.23](#)
24. Apply stone chip resistant coating. [TDL-PR1-3.24](#)
25. Restore corrosion-resistant coatings, caulking, and seam sealers to repaired areas. [TDL-PR1-3.25](#)
26. Prepare adjacent panels for blending. [TDL-PR1-3.26](#)
27. Identify and determine the materials, preparation and refinishing procedures of types of rigid, semi-rigid, or flexible plastic parts to be refinished. [TDL-PR1-3.27](#)
28. Identify metal parts to be refinished and determine the materials, preparation, and refinishing procedures. [TDL-PR1-3.28](#)

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**TDL-PR1-4. Examine and practice spray gun and related equipment operations.** [TDL-PR1-4](#)

1. Inspect the condition of spray guns and related equipment (air hoses, regulators, air lines, air source, and spray environment). [TDL-PR1-4.1](#)
2. Clean spray guns and related equipment (air hoses, regulators, air lines, air source, and spray environment). [TDL-PR1-4.2](#)
3. Determine the condition of spray guns and related equipment (air lines, air source, and spray environment). [TDL-PR1-4.3](#)
4. Demonstrate an understanding of selecting a spray gun set up (fluid, needle, nozzle, and cap) for product being applied. [TDL-PR1-4.4](#)
5. Test and adjust spray gun using fluid, air and pattern control valves. [TDL-PR1-4.5](#)
6. Demonstrate an understanding of the operation of pressure spray equipment. [TDL-PR1-4.6](#)

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**TDL-PR1-5. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects and competitive events.** TDL-PR1-5

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-PR1-5.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-PR1-5.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-PR1-5.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-PR1-5.4

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**Painting and Refinishing II (47.567)**

**TDL-PR2-1. Demonstrate employability skills required by business and industry.** TDL-PR2-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-PR2-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-PR2-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-PR2-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-PR2-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-PR2-1.5
6. Present a professional image through appearance, behavior and language. TDL-PR2-1.6

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**TDL-PR2-2. Demonstrate compliance with personal and environmental safety practices in accordance with local, state, and environmental regulations.** [TDL-PR2-2](#)

1. Identify and describe taking necessary precautions with hazardous operations and materials according to federal state and local regulations. [TDL-PR2-2.1](#)
2. Identify and explain safety and personal health hazards according to Occupational Safety and Health Administration (OSHA) guidelines and the "Right to Know" Law. [TDL-PR2-2.2](#)
3. Inspect and describe spray environments to ensure compliance with federal, state, and local regulations, and for safety and cleanliness hazards. [TDL-PR2-2.3](#)
4. Select and use the National Institute for Occupational Safety and Health (NIOSH)- approved cartridge respirator to inspect conditions and ensure fit and operations required for performing proper maintenance in accordance with OSHA regulations. [TDL-PR2-2.4](#)
5. Select and use the NIOSH-approved (fresh air make-up system) to perform proper maintenance in accordance to OSHA regulations. [TDL-PR2-2.5](#)
6. Select and use the proper personal safety equipment for surface preparation, spray gun and related equipment operation, paint mixing, matching and application, paint defects and detailing (gloves, suits, hoods, eye and ear protection, etc.). [TDL-PR2-2.6](#)

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**TDL-PR2-3. Explore and demonstrate paint mixing, matching and applying techniques.** TDL-PR2-3

1. Explore and perform explain various types of automotive paint. TDL-PR2-3.1
2. Determine typical locations of vehicle information plates or labels. TDL-PR2-3.2
3. Identify and describe the type and color code by manufacturer's vehicle information label. TDL-PR2-3.3
4. Identify and explain thinners and reducers for specific materials. TDL-PR2-3.4
5. Demonstrate the proper procedure to shake, stir, reduce, catalyze/activate, and strain refinish materials. TDL-PR2-3.5
6. Demonstrate and explain applying finish using appropriate spray techniques (gun arc, gun angle, gun distance, gun speed, and spray pattern overlap). TDL-PR2-3.6
7. Demonstrate and explain applying selected product on test and let down panel and checking for color match. TDL-PR2-3.7
8. Demonstrate and explain the proper procedure to apply a single stage topcoat. TDL-PR2-3.8
9. Demonstrate and explain the proper procedure to apply a basecoat/clear coat for blending or panel refinishing. TDL-PR2-3.9
10. Demonstrate and explain the proper procedure to apply a basecoat/clear coat for overall refinishing. TDL-PR2-3.10
11. Demonstrate and explain the proper procedure to remove nibs or imperfections from basecoat. TDL-PR2-3.11
12. Demonstrate and explain the proper procedure to refinish rigid or semi-rigid and plastic parts. TDL-PR2-3.12
13. Demonstrate and explain the proper procedure to refinish flexible plastic parts. TDL-PR2-3.13
14. Demonstrate and explain the proper procedure to apply multi-stage coats for panel blending or overall refinishing. TDL-PR2-3.14
15. Identify and perform the proper procedure to mix paint using a formula. TDL-PR2-3.15
16. Identify and perform the necessary action required to correct poor hiding colors. TDL-PR2-3.16
17. Identify and perform the proper procedure to tint color using formula to achieve blendable match. TDL-PR2-3.17
18. Identify and perform the proper procedure for alternative color formulas to achieve blendable match. TDL-PR2-3.18
19. Recognize the effects of light, position, and depth perception to include angles related to color determination. TDL-PR2-3.19

20. Compare the materials, equipment and preparation differences between solvent and waterborne technologies. [TDL-PR2-3.20](#)

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**TDL-PR2-4. Determine paint defect causes.** TDL-PR2-4

1. Identify blistering (raining of the paint surface, air entrapment) and determine the probable cause. TDL-PR2-4.1
2. Identify blushing (milky or hazy formation) and determine probable causes. TDL-PR2-4.2
3. Identify a dry spray appearance in the paint surface and determine the probable causes. TDL-PR2-4.3
5. Identify lifting and the probable causes. TDL-PR2-4.5
6. Identify clouding (mottling and streaking in metallic finishes) and determine the probable causes. TDL-PR2-4.6
7. Identify orange peel and determine the probable causes. TDL-PR2-4.7
8. Identify solvent popping in freshly painted surfaces and determine probable causes. TDL-PR2-4.8
9. Identify sags and runs in the paint surface and determine the probable causes. TDL-PR2-4.9
10. Identify sanding marks and sand scratch swelling and determine the probable causes. TDL-PR2-4.10
11. Identify contour mapping/edge mapping while the finish is drying and determine the probable causes. TDL-PR2-4.11
12. Identify color differences (off shade) and determine the probable causes. TDL-PR2-4.12
13. Identify tape tracking and determine the probable causes. TDL-PR2-4.13
14. Identify low gloss conditions and determine the probable causes. TDL-PR2-4.14
15. Identify poor adhesion and determine the probable causes. TDL-PR2-4.15
16. Identify paint cracking (shrinking, splitting, crowsfeet or line checking, micro checking, etc.) and determine the probable causes. TDL-PR2-4.16
17. Identify corrosion and determine the probable causes. TDL-PR2-4.17
18. Identify dirt or dust in the paint surface and determine the probable causes. TDL-PR2-4.18
19. Identify water spotting and determine the probable causes. TDL-PR2-4.19
20. Identify and explain the finish damage caused by bird droppings, tree sap, and other natural causes. TDL-PR2-4.20
21. Identify and explain the finish damage caused by airborne contaminants (acids, soot, rail dust, and other industrial related causes). TDL-PR2-4.21

22. Identify dieback conditions (dulling of the paint film showing haziness) and determine the probable causes. [TDL-PR2-4.22](#)
23. Identify chalking (oxidation) and determine the probable causes. [TDL-PR2-4.23](#)
24. Identify bleed-through (staining) and determine the probable causes. [TDL-PR2-4.24](#)
25. Identify pin-holing and determine the probable causes. [TDL-PR2-4.25](#)
26. Identify and describe buffing related imperfections (swirl marks, wheel burns). [TDL-PR2-4.26](#)
27. Identify pigment floatation (color change through film build) and determine the probable causes. [TDL-PR2-4.27](#)

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**TDL-PR2-5. Identify paint defect cures and practice various correction techniques.** TDL-PR2-5

1. Identify blistering (raining of the paint surface, air entrapment) and perform correction procedures. TDL-PR2-5.1
2. Identify blushing (milky or hazy formation) and perform correction procedures. TDL-PR2-5.2
3. Identify a dry spray appearance in the paint surface and perform correction procedures. TDL-PR2-5.3
4. Identify the presence of fish-eyes (cater like openings) in the finish and perform correction procedures. TDL-PR2-5.4
5. Identify the lifting condition and perform correction procedures. TDL-PR2-5.5
6. Identify clouding (mottling and streaking in metallic finishes) and perform correction procedures. TDL-PR2-5.6
7. Identify the orange peel condition and perform correction procedures. TDL-PR2-5.7
8. Identify the solvent popping condition in freshly-painted surfaces and perform correction procedures. TDL-PR2-5.8
9. Identify sags and runs in the paint surface and perform correction procedures. TDL-PR2-5.9
10. Identify sanding marks and sand scratch swelling and perform correction procedures. TDL-PR2-5.10
11. Identify contour mapping/edge mapping while the finish is drying and perform necessary procedures. TDL-PR2-5.11
12. Identify color differences (off shade) and perform correction procedures. TDL-PR2-5.12
13. Identify tape tracking and perform correction procedures. TDL-PR2-5.13
14. Identify low gloss conditions and perform correction procedures. TDL-PR2-5.14
15. Identify poor adhesion and perform correction procedures. TDL-PR2-5.15
16. Identify paint cracking (shrinking, splitting, crowsfeet or line checking, micro checking, etc.) and perform correction procedures. TDL-PR2-5.16
17. Identify corrosion and perform correction procedures. TDL-PR2-5.17
18. Identify dirt or dust in the paint surface and perform correction procedures. TDL-PR2-5.18
19. Identify water spotting and perform correction procedures. TDL-PR2-5.19
20. Identify the finish damage caused by bird droppings, tree sap, and other natural causes and perform the correction procedures. TDL-PR2-5.20

21. Identify the finish damage caused by airborne contaminants (acids, soot, rail dust, and other industrial related causes) and perform correction procedures. [TDL-PR2-5.21](#)
22. Identify dieback conditions (dulling of the paint film showing haziness) and perform the correction procedures. [TDL-PR2-5.22](#)
23. Identify chalking (oxidation) and perform the correction procedures. [TDL-PR2-5.23](#)
24. Identify bleed-through (staining) and perform the correction procedures. [TDL-PR2-5.24](#)
25. Identify pin-holing and perform the correction procedures. [TDL-PR2-5.25](#)
26. Identify buffing-related imperfections (swirl marks, wheel burns) and perform the correction procedures. [TDL-PR2-5.26](#)
27. Identify pigment floatation (color change through film build) and perform the correction procedures. [TDL-PR2-5.27](#)

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**TDL-PR2-6. Perform final detailing procedures.** [TDL-PR2-6](#)

1. Identify and demonstrate the proper procedures to apply decals, transfers, tape, woodgrains, pinstripes (painted and taped) to vehicles. [TDL-PR2-6.1](#)
2. Identify and demonstrate the proper procedures to sand, buff, and polish fresh or existing finish to remove defects, as required. [TDL-PR2-6.2](#)
3. Identify and demonstrate cleaning the interior, exterior and the glass of the vehicle. [TDL-PR2-6.3](#)
4. Describe and demonstrate the proper procedures to clean all body openings (door jambs and edges, etc.). [TDL-PR2-6.4](#)
5. Describe and demonstrate the proper procedure to remove overspray. [TDL-PR2-6.5](#)
6. Summarize and perform vehicle clean-up and completing quality control using a checklist. [TDL-PR2-6.6](#)

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**TDL-PR2-7. Examine how related student organizations are integral parts of career and technology education courses through leadership development, school and community service projects and competitive events.** TDL-PR2-7

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-PR2-7.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-PR2-7.2
3. Explore the impact and opportunities SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-PR2-7.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-PR2-7.4

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**TDL-PR2-44. Identify the presence of fish-eyes (cater like openings) in the finish and the probable causes.** TDL-PR2-44

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**Non-Structural Analysis and Damage Repair I (47.568)**

**TDL-NSADR1-1. Demonstrate employability skills required by business and industry.** TDL-NSADR1-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-NSADR1-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-NSADR1-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-NSADR1-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-NSADR1-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-NSADR1-1.5
6. Present a professional image through appearance, behavior and language. TDL-NSADR1-1.6

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**TDL-NSADR1-2. Demonstrate preparation by properly inspecting, removing, storing and installing components.** TDL-NSADR1-2

1. Inspect, remove, label, store, and reinstall vehicle mechanical and electrical components that may interfere with or be damaged during repair. TDL-NSADR1-2.1

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**TDL-NSADR1-3. Demonstrate outer body panel repairs, replacements, and adjustments.** TDL-NSADR1-3

1. Inspect, remove and replace bolted, bonded, and welded steel panel or panel assemblies. TDL-NSADR1-3.1
2. Determine the extent of damage to aluminum body panels; repair or replace. TDL-NSADR1-3.2
3. Inspect, remove, replace and align tailgates, hatches, lift gates and sliding doors. TDL-NSADR1-3.3
4. Straighten contours of damaged panels to a suitable condition for body filling or metal. TDL-NSADR1-3.4
5. Weld damaged or torn steel body panels; repair broken welds. TDL-NSADR1-3.5
6. Replace door skins. TDL-NSADR1-3.6
7. Restore sound deadeners and foam materials. TDL-NSADR1-3.7
8. Perform panel bonding and weld bonding. TDL-NSADR1-3.8
9. Diagnose and repair water leaks, dust leaks, and wind noise. TDL-NSADR1-3.9
10. Identify one-time use fasteners. TDL-NSADR1-3.10

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**TDL-NSADR1-4. Identify and demonstrate repairing metal finishing and body filling.** TDL-NSADR1-4

1. Identify and explain different types of body fillers. TDL-NSADR1-4.1
2. Demonstrate rough sanding body filler to contour; finishing sand. TDL-NSADR1-4.2
3. Determine the proper metal finishing techniques for aluminum. TDL-NSADR1-4.3
4. Determine proper application of body filler to aluminum. TDL-NSADR1-4.4

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**TDL-NSADR1-5. Demonstrate moveable glass and hardware repair and replacement.** TDL-NSADR1-5

1. Inspect, adjust, repair, remove, reinstall or replace weather-stripping. TDL-NSADR1-5.1
2. Inspect, repair or replace, and adjust removable power operated roof panel and hinges, latches, guides, handles, retainer, and controls of sunroofs. TDL-NSADR1-5.2
3. Inspect, remove, reinstall, and align convertible top and related mechanisms. TDL-NSADR1-5.3
4. Initialize electrical components as needed. TDL-NSADR1-5.4

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**TDL-NSADR1-6. Demonstrate metal welding and cutting as it relates to vehicle repair.** TDL-NSADR1-6

1. Weld and cut aluminum. TDL-NSADR1-6.1
2. Identify different methods of attaching non-structural components (squeeze type resistant spot welds (STRSW), riveting, non-structural adhesive, silicon bronze, etc.). TDL-NSADR1-6.2

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**TDL-NSADR1-7. Demonstrate vehicle repairs using plastics and adhesives.** TDL-NSADR1-7

1. Remove or repair damaged areas from rigid exterior composite panels. TDL-NSADR1-7.1
2. Replace bonded rigid exterior composite body panels; straighten or align panel supports. TDL-NSADR1-7.2

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**TDL-NSADR1-8. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-NSADR1-8

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-NSADR1-8.1
  2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-NSADR1-8.2
  3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-NSADR1-8.3
  4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-NSADR1-8.4
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**Non-Structural Analysis  
and Damage Repair II  
(47.569)**

**TDL-NSADR2-1. Demonstrate employability skills required by business and industry.** TDL-NSADR2-1

1. Communicate effectively through writing, speaking, listening, reading, and interpersonal abilities. TDL-NSADR2-1.1
2. Demonstrate creativity by asking challenging questions and applying innovative procedures and methods. TDL-NSADR2-1.2
3. Exhibit critical thinking and problem solving skills to locate, analyze and apply information in career planning and employment situations. TDL-NSADR2-1.3
4. Model work readiness traits required for success in the workplace including integrity, honesty, accountability, punctuality, time management, and respect for diversity. TDL-NSADR2-1.4
5. Apply the appropriate skill sets to be productive in a changing, technological, diverse workplace to be able to work independently and apply team work skills. TDL-NSADR2-1.5
6. Present a professional image through appearance, behavior and language. TDL-NSADR2-1.6

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**TDL-NSADR2-2. Demonstrate preparation by properly inspecting, removing, storing, and installing components.** TDL-NSADR2-2

1. Review damage report and analyze damage to determine appropriate methods for overall repair; develop and document a repair plan. TDL-NSADR2-2.1
2. Inspect, remove, label, store, and reinstall exterior trim and moldings. TDL-NSADR2-2.2
3. Inspect, remove, label, store, and reinstall interior trim and components. TDL-NSADR2-2.3
4. Inspect, remove, label, store, and reinstall body panels and components that may interfere with or be damaged during repair. TDL-NSADR2-2.4
5. Protect panels, glass, interior parts, and other vehicles adjacent to the repair area. TDL-NSADR2-2.5
6. Soap and water wash entire vehicle; complete pre-repair inspection checklist. TDL-NSADR2-2.6
7. Prepare damaged area using water-based and solvent-based cleaners. TDL-NSADR2-2.7
8. Remove corrosion protection, undercoatings, sealers, and other protective coatings as necessary to perform repairs. TDL-NSADR2-2.8
9. Inspect, remove, and reinstall repairable plastics and other components for off-vehicle repair. TDL-NSADR2-2.9

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**TDL-NSADR2-3. Demonstrate outer body panel repairs, replacements, and adjustments.** TDL-NSADR2-3

1. Determine the extent of direct and indirect/hidden damage and direction of impact; develop and document a repair plan. TDL-NSADR2-3.1
2. Inspect, remove, replace, and align hood, hood hinges, and hood latch. TDL-NSADR2-3.2
3. Inspect, remove, replace, and align deck lid, lid hinges, and lid latch. TDL-NSADR2-3.3
4. Inspect, remove, replace, and align doors, latches, hinges, and related hardware. TDL-NSADR2-3.4
5. Inspect, remove, replace, and align bumper bars, covers, reinforcement, guards, isolators, and mounting hardware. TDL-NSADR2-3.5
6. Inspect, remove, replace and align fenders, and related panels. TDL-NSADR2-3.6
7. Restore corrosion protection. TDL-NSADR2-3.7

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**TDL-NSADR2-4. Identify and demonstrate repairing metal finishing and body filling.** TDL-NSADR2-4

1. Remove paint from the damaged area of a body panel. TDL-NSADR2-4.1
2. Locate and repair surface irregularities on a damaged body panel. TDL-NSADR2-4.2
3. Demonstrate hammer and dolly techniques. TDL-NSADR2-4.3
4. Heat shrink stretched panel areas to proper contour. TDL-NSADR2-4.4
5. Cold shrink stretched panel areas to proper contour. TDL-NSADR2-4.5
6. Prepare and apply body filler. TDL-NSADR2-4.6

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**TDL-NSADR2-5. Demonstrate moveable glass and hardware repair and replacement.** TDL-NSADR2-5

1. Inspect, adjust, repair or replace window regulators, run channels, glass, power mechanisms, and related controls. TDL-NSADR2-5.1

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**TDL-NSADR2-6. Demonstrate metal welding and cutting related to vehicle repair.** TDL-NSADR2-6

1. Identify weldable and non-weldable substrates used in vehicle construction. TDL-NSADR2-6.1
2. Weld and cut high-strength steel and other steels. TDL-NSADR2-6.2
3. Determine the correct gas metal arc welding (GMAW) metal inert gas (MIG) welder type, electrode/wire type, diameter, and gas to be used in a specific welding situation. TDL-NSADR2-6.3
4. Set up and adjust the GMAW (MIG) welder to "tune" for proper electrode stick out, voltage, polarity, flow rate, and wire-feed speed required for the substrate being welded. TDL-NSADR2-6.4
5. Store, handle, and install high-pressure gas cylinders. TDL-NSADR2-6.5
6. Determine location and attach work clamp (ground). TDL-NSADR2-6.6
7. Use the proper angle of the gun to the joint and direction of gun travel for the type of weld being made in the flat, horizontal, vertical, and overhead positions. TDL-NSADR2-6.7
8. Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations. TDL-NSADR2-6.8
9. Protect computers and other electronic control modules during welding procedures. TDL-NSADR2-6.9
10. Clean and prepare the metal to be welded, assure good metal fit-up, and apply weld through primer, if necessary, clamp or tack as required. TDL-NSADR2-6.10
11. Determine the joint type (butt weld with backing, lap, etc.) for weld being made. TDL-NSADR2-6.11
12. Determine the type of weld (continuous, stitch weld, plug, etc.) for each specific welding operation. TDL-NSADR2-6.12
13. Perform the following welds: continuous, plug, butt weld with and without backing, fillet, etc. TDL-NSADR2-6.13
14. Perform visual and destructive tests on each weld type. TDL-NSADR2-6.14
15. Identify the causes of various welding defects; make necessary adjustments. TDL-NSADR2-6.15
16. Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments. TDL-NSADR2-6.16
17. Identify cutting process for different substrates and locations; perform cutting operation. TDL-NSADR2-6.17

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**TDL-NSADR2-7. Demonstrate vehicle repairs using plastics and adhesives 7.1**  
**Identify the types of plastics; determine repairability.** TDL-NSADR2-7

2. Clean and prepare the surface of plastic parts; identify the types of plastic repair procedures. TDL-NSADR2-7.2
3. Repair rigid, semi-rigid, or flexible plastic panels. TDL-NSADR2-7.3

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**TDL-NSADR2-8. Examine how SkillsUSA is a co-curricular part of career and technical education through leadership development, school and community service projects, and competitive events.** TDL-NSADR2-8

1. Explain the purpose, mission, objectives, motto, colors, official dress and other distinguishing characteristics of SkillsUSA. TDL-NSADR2-8.1
2. Explain how participation in SkillsUSA can promote lifelong responsibility for community service, professional growth and development. TDL-NSADR2-8.2
3. Explore the impact and opportunities that SkillsUSA can develop to bring business and industry together with education in a positive working relationship through innovative leadership and career development programs. TDL-NSADR2-8.3
4. Explore the local, state, and national opportunities available to students through participation in SkillsUSA, including but not limited to conferences, competitions, community service, philanthropy, and other SkillsUSA activities. TDL-NSADR2-8.4

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**Foundations of Marine  
Engine Technology**

**ACCT-FME-1. Students will explore the different careers available in the field of marine engine technology.** ACCT-FME-1

- Explore career opportunities in marine engine technology. ACCT-FME-1A.
- Describe the roles and functions of individuals engaged in marine engine technology. ACCT-FME-1B.
- Explore opportunities for employment in marine engine technology. ACCT-FME-1C.
- Explore opportunities for entrepreneurial endeavors. ACCT-FME-1D.

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**ACCT-FME-2. Students will understand basic concepts and practices necessary for effective marine shop operation.** ACCT-FME-2

- . Demonstrate basic shop safety skills. ACCT-FME-2A.
- . Identify and demonstrate US Coast Guard and US Boating safety rules and regulations. ACCT-FME-2B.
- . Operate hand tools safely and properly. ACCT-FME-2C.
- . Operate tools and precision instruments for observing, measuring, and manipulating equipment and materials. ACCT-FME-2D.
- . Set up, use, and maintain power tools safely and properly. ACCT-FME-2E.
- . Identify all applicable federal, state and local laws, OSHA and EPA regulations in the operation of a marine shop. ACCT-FME-2F.

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**ACCT-FME-3. Students will learn about various fasteners and their applications.** ACCT-FME-3

- . Identify and use different grades and types of fasteners. ACCT-FME-3A.
- . Measure the torque of various fasteners used in the marine engine industry. ACCT-FME-3B.
- . Identify the properties and apply various sealants appropriately. ACCT-FME-3C.

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**ACCT-FME-4. Students will describe shop management systems and procedures.** ACCT-FME-4

- . Describe inventory management procedures. ACCT-FME-4A.
- . Operate personal computers and software to access inventory databases. ACCT-FME-4B.
- . Demonstrate customer service skills. ACCT-FME-4C.
- . Write customer service orders. ACCT-FME-4D.

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**ACCT-FME-5. Students will use and interpret information from various industry literature sources.** ACCT-FME-5

- . Select and apply service manuals for all types of marine engines. ACCT-FME-5A.
  - . Interpret and use service bulletins. ACCT-FME-5B.
  - . Interpret and apply service bulletins for all brands and types of marine engines. ACCT-FME-5C.
  - . Select appropriate online parts information for model engine undergoing service. ACCT-FME-5D.
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## Marine Electrical Systems

### **ACCT-MES-1. Students will demonstrate knowledge of electromagnetic and electrical theory, circuit analysis, and electrical system diagnosis and repair.** ACCT-MES-1

- . Explain the basic principles of magnetism. ACCT-MES-1A.
- . Explain basic electrical theory. ACCT-MES-1B.
- . Define and create basic DC and AC circuits as well as describe their differences. ACCT-MES-1C.
- . Locate and identify electrical circuit components. ACCT-MES-1D.
- . Identify types of analog and digital meters used in marine electrical servicing. ACCT-MES-1E.
- . Set up and use analog and digital voltmeters, ammeters, and ohmmeters. ACCT-MES-1F.
- . Diagnose circuit problems using digital multi-meter to record voltage drop. ACCT-MES-1G.
- . Measure and record circuit readings using a VOA meter. ACCT-MES-1H.
- . Define Ohm's Law and the relationship among voltage, amperage, and resistance. ACCT-MES-1I.
- . Describe a series and a parallel circuit. ACCT-MES-1J.
- . Analyze circuit problems using Ohm's Law. ACCT-MES-1K.
- . Identify stray voltage causes in salt and fresh water boating environments. ACCT-MES-1L.

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### **ACCT-MES-2. Students will safely demonstrate knowledge of battery concepts, diagnosis, maintenance, and repair.** ACCT-MES-2

- . Describe different types of batteries and their application. ACCT-MES-2A.
- . Set up and use test equipment to troubleshoot batteries. ACCT-MES-2B.
- . Safely perform battery state of charge test and determine necessary action. ACCT-MES-2C.
- . Perform battery capacity test and confirm proper battery capacity for vessel application and then determine necessary action. ACCT-MES-2D.
- . Perform battery charge. ACCT-MES-2E.
- . Inspect, clean, fill and/or replace battery, battery cables, connectors, clamps, and hold downs. ACCT-MES-2F.
- . Start a vessel using auxiliary power supply. ACCT-MES-2G.
- . Identify electronic modules and other accessories that require re-initialization and code entry after battery disconnect. ACCT-MES-2H.

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**ACCT-MES-3. Students will demonstrate knowledge of starting system concepts, diagnosis, maintenance, and repair.** ACCT-MES-3

- Perform starter current draw tests and determine necessary action. ACCT-MES-3A.
- Perform starter circuit voltage drop tests and determine necessary action. ACCT-MES-3B.
- Inspect and test starter relays and solenoids and determine necessary action. ACCT-MES-3C.
- Remove and install starter in a vessel. ACCT-MES-3D.
- Inspect and test switches, connectors, and wires of starter control circuits and perform necessary action. ACCT-MES-3E.
- Differentiate between electrical and engine mechanical problems that cause a slow- crank or no-crank condition. ACCT-MES-3F.

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**ACCT-MES-4. Demonstrate knowledge of charging system concepts, diagnosis, maintenance, and repair.** ACCT-MES-4

- Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions. ACCT-MES-4B.
  - Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners and check pulley and belt alignment. ACCT-MES-4C.
  - Perform charging circuit voltage drop tests and determine necessary action. ACCT-MES-4D.
  - Perform charging system output test and determine necessary action. ACCT-MES-4A.
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## Marine Engine Drive Systems (MED)

### **ACCT-MED-1. Students will understand theory of operation as well as evaluate problems and repair a basic marine diesel or gas four stroke Internal combustion engine.** ACCT-MED-1

- Explain the basic principles of operation for marine diesel and gas four-stroke internal combustion engines. ACCT-MED-1A.
- Identify types of four-stroke internal combustion diesel and gas engines. ACCT-MED-1B.
- Check engine oil level; check engine for oil, coolant, and fuel leaks (Engine Off). ACCT-MED-1C.
- Check engine starting/operation (including unusual noises, vibrations, exhaust smoke, etc.); record idle and governed rpm. ACCT-MED-1D.
- Check engine for oil, coolant, air, and fuel leaks (Engine Running). ACCT-MED-1E.
- Conduct test of four-stroke engine power head operation. ACCT-MED-1F.
- Diagnose, inspect, and service cylinder head and valve train problems. ACCT-MED-1G.
- Execute four cycle engine valve timing procedures. ACCT-MED-1H.
- Diagnose, inspect, and service camshafts, lifters, timing chain, sprockets and gears. ACCT-MED-1I.
- Explain block repair methods including honing, boring, and sleeving. ACCT-MED-1J.
- Communicate procedures for basic block salvaging. ACCT-MED-1K.

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### **ACCT-MED-2. Students will understand theory of operation as well as assess and repair a basic marine two stroke engine.** ACCT-MED-2

- Explain the basic principles of operation for marine two-stroke internal combustion engines. ACCT-MED-2A.
- Analyze types of two-stroke internal combustion engines. ACCT-MED-2B.
- Perform and test two-stroke engine power head operation. ACCT-MED-2C.
- Diagnose and identify power head failure and their causes, including pre-ignition and detonation. ACCT-MED-2D.
- Diagnose, inspect, repair, and remove&replace cylinder and crank case assemblies, crank shafts, rod and piston assemblies, cylinder heads, and bearings and seals. ACCT-MED-2E.
- Examine two stroke engine power head operation. ACCT-MED-2F.
- Explain block repair methods including honing, boring, and sleeving. ACCT-MED-2G.
- Explain and apply basic powerhead salvaging procedures and repair damaged threads and install thread repair inserts. ACCT-MED-2H.

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**ACCT-MED-3. Students will understand theory of operation of inboard and outboard drive systems, transom bracket servicing and repair of the upper and lower gear case.** ACCT-MED-3

- Discuss the in board drive system 3b. Diagnose, inspect, and service prop shaft systems 3c. Inspect and service prop shaft bearings, seals and mountings. ACCT-MED-3A.
- Describe power transmission for inboard diesel engines. ACCT-MED-3D.
- Discuss the basic principles of the transom assembly. ACCT-MED-3E.
- Diagnose, inspect, and repair the transom assembly. ACCT-MED-3F.
- Explain the upper gear case assembly, theory, and operation. ACCT-MED-3G.
- Disassemble, inspect, and reassemble upper gear and lower gear case assemblies. ACCT-MED-3H.
- Describe and perform shimming procedures and gear lash inspection. ACCT-MED-3I.
- Perform pressure and vacuum leak test. ACCT-MED-3J.

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**• Communicate and demonstrate service procedures on midsection, replace motor mounts and shock absorbers, replace reverse lock mechanisms.** ACCT-MED-4A.

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**• Describe, diagnose, and assess the hydraulic trim and tilt system operating principles and component operations and verify their proper function through setup and the use of hydraulic testers.** ACCT-MED-4B.

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**• Set up and use hydraulic testers to troubleshoot outboard and stern drive tilt and trim systems.** ACCT-MED-4C.

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**Students. will understand theory of operation of the outboard midsection.** ACCT-MED-4. STUDENTS

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**ACCT-MED-5. Students will understand diesel and gas engine fuel systems including tank, line, filter, and pump and hose components, and explain their operation.** ACCT-MED-5

- . Demonstrate the operation of two and four cycle carburetors. ACCT-MED-5A.
- . Describe diesel fuel injections systems. ACCT-MED-5B.
- . Check fuel tanks, mountings, lines, caps, and vents. ACCT-MED-5C.
- . Inspect throttle linkages and return springs. ACCT-MED-5D.
- . Describe reed valve operation as used in two cycle engines. ACCT-MED-5E.
- . Explain two and four cycle diesel and gas fuel pump operations. ACCT-MED-5F.
- . Diagnose and inspect the different types of oil metering systems used in outboard motors. ACCT-MED-5G.
- . Conduct a fuel systems pressure and vacuum test to diagnose fuel pump operation and to isolate boat fuel system problems. ACCT-MED-5H.
- . Inspect boat fuel system components for leaks, wear, and damage. ACCT-MED-5I.
- . Inspect water separator/fuel heater; replace fuel filter(s); prime and bleed fuel system. ACCT-MED-5J.
- . Relate electronic fuel injection theory and operation. ACCT-MED-5K.
- . Identify the major components of the diesel and gas fuel injection systems and explain their operation in two and four cycle fuel injection systems. ACCT-MED-5L.
- . Calibrate components of a diesel and gas fuel injection system in accordance to manufacturer's specifications. ACCT-MED-5M.
- . Check air induction system: piping, charge air cooler, hoses, clamps, and mountings; check for air restrictions and leaks. ACCT-MED-5N.
- . Service or replace air filter as needed; check and reset air filter restriction indicator. ACCT-MED-5O.

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**ACCT-MED-6. Students will be able to explain the water cooling system from the intake ports through the water pump and through the cooling passages including the thermostats, manifolds, elbows, and other related cooling items for both two and four stroke diesel and gas engines.** ACCT-MED-6

- Track water flow through cooling systems and utilize water flow diagrams. ACCT-MED-6A.
- Describe and diagnose overheating conditions on two and four cycle diesel and gas marine engines, disassemble, inspect, and reassemble inboard and outboard cooling system components, including thermostats, coolant hoses, clamps, bypass valves, water pump assembly and pressure relief components. ACCT-MED-6B.
- Inspect and service heat exchanger 6d. Inspect and service coolant filter/conditioner. ACCT-MED-6C.
- Disassemble, inspect, and reassemble stern drive cooling system components including thermostats, bypass valves, water pump assembly, and pressure relief components. ACCT-MED-6E.
- Check coolant for contamination, supplemental coolant additives (SCA) concentration, and protection level (freeze point). ACCT-MED-6F.

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**ACCT-MED-7. Students will understand how to layout, measure, and install marine accessories.** ACCT-MED-7

- Measure and install accessories utilizing holes awls, electrical connectors, and proper soldering procedures. ACCT-MED-7A.
- Apply Ohm's Law in relation to measuring resistance in marine accessory systems. ACCT-MED-7B.
- Set up and program marine accessories to manufacturer's specifications. ACCT-MED-7C.