MASSACHUSETTS
DEPARTMENT of
EDUCATION

Vocational Technical Education Framework

Transportation Cluster

Automotive Technology

August 2007

Massachusetts Department of Education

Career/Vocational Technical Education Unit
address 350 Main Street, Malden, MA 02148
telephone 781-338-3910
internet www.doe.mass.edu/cte/
email careertech@doe.mass.edu

Strand 1: Safety and Health Knowledge and Skills

1.A Define health and safety regulations.

- 1.A.01a Identify and apply OSHA and other health and safety regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.02a Identify and apply EPA and other environmental protection regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.03a Identify and apply Right-To-Know (Hazard Communication Policy) and other communicative regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.04a Explain procedures for documenting and reporting hazards to appropriate authorities.
- 1.A.05a List penalties for non-compliance with appropriate health and safety regulations.
- 1.A.06a Identify contact information for appropriate health and safety agencies and resources.

1.B Demonstrate health and safety practices.

- 1.B.01a Identify, describe and demonstrate the effective use of Material Safety Data Sheets (MSDS).
- 1.B.02a Read chemical, product, and equipment labels to determine appropriate health and safety considerations.
- 1.B.03a Identify, describe and demonstrate personal, shop and job site safety practices and procedures.
- 1.B.04a Demonstrate safe dress and use of relevant safety gear and personal protective equipment (PPE), including wrist rests, adjustable workspaces and equipment, gloves, boots, earplugs, eye protection, and breathing apparatus.
- 1.B.05a Illustrate appropriate safe body mechanics, including proper lifting techniques and ergonomics.
- 1.B.06a Locate emergency equipment in your lab, shop, and classroom, including (where appropriate) eyewash stations, shower facilities, sinks, fire extinguishers, fire blankets, telephone, master power switches, and emergency exits.
- 1.B.07a Demonstrate the safe use, storage, and maintenance of every piece of equipment in the lab, shop, and classroom.
- 1.B.08a Describe safety practices and procedures to be followed when working with and around electricity.
- 1.B.09a Properly handle, store, dispose of, and recycle hazardous, flammable, and combustible materials.
- 1.B.10a Illustrate proper handling and storage practices, including working with hazardous materials, disposal, and recycling.
- 1.B.11a Demonstrate proper workspace cleaning procedures.

1.C Demonstrate responses to situations that threaten health and safety.

- 1.C.01a Illustrate First Aid procedures for potential injuries and other health concerns in the occupational area.
- 1.C.02a Describe the importance of emergency preparedness and an emergency action plan.

1.C.03a	Illustrate procedures used to handle emergency situations and accidents, including identification, reporting, response, evacuation plans, and follow-up procedures.
1.C.04a	Identify practices used to avoid accidents.
1.C.05a	Identify and describe fire protection, precautions, and response procedures.
1.C.06a	Discuss the role of the individual and the company/organization in ensuring workplace safety.
1.C.07a	Discuss ways to identify and prevent workplace/school violence.

Strand 2: Technical Knowledge and Skills

2.A Compare and contrast fasteners.

2.A.01c Identify commonly used threaded fasteners.
2.A.02c Identify SAE bolt head markings.
2.A.03c Identify metric bolt head markings.
2.A.04c Identify commonly used nuts.
2.A.05c Identify commonly used washers.
2.A.06c Explain the need for flat washers and lock washers.
2.A.07c Identify and describe machine screws.
2.A.08c Identify and describe commonly used snap rings.
2.A.09c Explain the concept of fastener torque.
2.A.10c Explain how to find fastener torque specifications.
2.A.11c Explain when to use a general fastener torque chart.
2.A.12c Explain what torque sequence refers to.
2.A.13c Describe the various types of torque wrenches.
2.A.14c Explain the basic rules to follow when using a torque wrench.

Performance Example:

1. Torque fasteners according to manufacturer's specifications and according to sequence.

2.B Demonstrate proper measuring procedures.

2.B.01c Describe commonly used low precision measuring tools (steel rule, tape measure, ruler, and combination square).
2.B.02c Identify an outside caliper and demonstrate its use.
2.B.03c Identify and inside caliper and demonstrate its use.
2.B.04c Identify a feeler gauge and demonstrate its use.
2.B.05c Identify a hole gauge and demonstrate its use.
2.B.06c Identify a telescoping/snap gauge and demonstrate its use.
2.B.07c Identify a vernier caliper and demonstrate its use.
2.B.08c Identify an outside micrometer and demonstrate its use.
2.B.09c Identify an inside micrometer and demonstrate its use.
2.B.10c Identify a depth indicator gauge and demonstrate its use.
2.B.11c Identify a dial indicator and demonstrate its use.

Performance Example:

1. Demonstrate measurement skills using both American and metric system using variety of tool.

2.C Demonstrate the use of hand tools.

2.C.01c Identify types of screwdrivers.
2.C.02c Identify types of pliers.
2.C.03c Identify types of combination wrenches.
2.C.04c Identify open-end wrenches.
2.C.05c Identify box end wrenches.
2.C.06c Identify types of punches.
2.C.07c Identify types of chisel.
2.C.08c Identify types of hammers.
2.C.09c Identify types of pipe wrenches.
2.C.10c Identify types of adjustable wrenches.
2.C.11c Identify types of sockets.

2.C.12c Identify types of extensions.
2.C.13c Identify types of torque wrenches.
2.C.14c Identify types of Allen wrenches.
2.C.15c Identify various types of files.
2.C.16c Identify types of hacksaws.
2.C.17c Identify various types of thread cutting taps.
2.C.18c Identify various types of thread cutting dies.
2.C.19c Identify a tubing cutter.
2.C.20c Identify a double flaring tool.
2.C.21c Identify an ISO flaring tool.
2.C.22c Identify different types of gasket scrapers.
2.C.23c Identify types of wire brushes.
2.C.24c Identify types of bench vises.

Performance Example:
1. Student chooses correct tools to match assigned task.

2.D Demonstrate the use of power tools.

2.D.01c Drill holes to given specifications using an electric drill.
2.D.02c Identify types of drill bits.
2.D.03c Describe the difference in drilling speed for different metals.
2.D.04c Describe safety procedures to be followed when using an electric drill.
2.D.05c Identify and explain the purpose of an air impact wrench.
2.D.06c Identify and explain the purpose of impact sockets.
2.D.07c Describe maintenance needs of an impact wrench.
2.D.08c Describe safety procedures to follow when using an air impact wrench.
2.D.09c Identify and explain the purpose of an electric soldering iron.
2.D.10c Describe safety procedures to be followed when using an electric soldering iron.
2.D.11c List the type of solder to use when soldering electrical component.
2.D.12c Identify and explain the purpose of a bench grinder.
2.D.13c Describe safety procedures to follow when using a bench grinder.

Performance Examples:
1. Select the correct tool to drill a hole.
2. Choose the correct tools and supplies to solder an electrical connection.

2.E Determine service and vehicle information.

2.E.01 Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.
2.E.02 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals).

2.F Diagnose and repair steering systems.

2.F.01 Identify and interpret suspension and steering concern; determine necessary action.
2.F.02 Disable and enable supplemental restraint system (SRS).
2.F.03 Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).

2.F.04 Identify steering column noises, looseness, and binding concerns (including tilt mechanisms).
2.F.05 Identify power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns.
2.F.06 Remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets.
2.F.07 Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.
2.F.08 Inspect power steering fluid levels and condition.
2.F.09 Flush, fill, and bleed power steering system.
2.F.10 Diagnose power steering fluid leakage; determine necessary action.
2.F.11 Remove, inspect, replace, and adjust power steering pump belt.
2.F.12 Remove and reinstall power steering pump.
2.F.13 Inspect and replace power steering hoses and fittings.
2.F.14 Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper.
2.F.15 Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps.

2.G Diagnose and repair front suspension systems.

2.G.01 Inspect short and long arm suspension system noises, body sway, and uneven riding height concerns.
2.G.02 Inspect strut suspension system noises, body sway, and uneven riding height concerns.
2.G.03 Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers.
2.G.04 Remove, inspect and install strut rods (compression/tension) and bushings.
2.G.05 Remove, inspect, and install upper and/or lower ball joints.
2.G.06 Remove, inspect, and install steering knuckle assemblies.
2.G.07 Remove, inspect, and install short and long arm suspension system coil springs and spring insulators.
2.G.08 Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts.
2.G.09 Remove, inspect, and install stabilizer bar bushings, brackets, and links.
2.G.10 Remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.
2.G.11 Lubricate suspension and steering systems.

2.H Diagnose and repair rear suspension systems.

2.H.01 Remove, inspect, and install coil springs and spring insulators.
2.H.02 Remove, inspect, and install transverse links, control arms, bushings, and mounts.
2.H.03 Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts.
2.H.04 Remove, inspect, and install strut cartridge or assembly, strut coil spring, and insulators (silencers).

2.I Diagnose and repair miscellaneous suspension systems.

2.I.01 Inspect, remove, and replace shock absorbers.

2.I.02 Remove, inspect, and service or replace front and rear wheel bearings.

2.J Diagnose and repair wheel adjustment problems.

2.J.01 Differentiate between steering and suspension concerns using principles of steering geometry (caster, camber, toe, etc).

2.J.02 Inspect vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns.

2.J.03 Perform prealignment inspection; perform necessary action.

2.J.04 Measure vehicle riding height; determine necessary action.

2.J.05 Check and adjust front and rear wheel camber; perform necessary action.

2.J.06 Check and adjust caster; perform necessary action.

2.J.07 Check and adjust front wheel toe; adjust as needed.

2.J.08 Center steering wheel.

2.J.09 Check toe-out-on-turns (turning radius); determine necessary action.

2.J.10 Check SAI (steering axis inclination) and included angle; determine necessary action.

2.J.11 Check and adjust rear wheel toe.

2.J.12 Check rear wheel thrust angle; determine necessary action.

2.J.13 Check for front wheel setback; determine necessary action

2.K Diagnose and repair wheel and tire problems.

2.K.01 Diagnose tire wear patterns; determine necessary action.

2.K.02 Inspect tires; check and adjust air pressure.

2.K.03 Rotate tires according to manufacturer's recommendations.

2.K.04 Measure wheel, tire, axle, and hub runout; determine necessary action.

2.K.05 Balance wheel and tire assembly (static and dynamic).

2.K.06 Dismount, inspect, repair, and remount tire on wheel.

2.K.07 Reinstall wheel; torque lug nuts.

2.K.08 Inspect and repair tire.

2.L Diagnose and repair general brake systems.

2.L.01 Identify and interpret brake system concern; determine necessary action.

2.L.02 Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins.

2.M Diagnose and repair hydraulic systems.

2.M.01 Diagnose pressure concerns in the brake system using hydraulic principles (Paschal's Law).

2.M.02 Measure brake pedal height; determine necessary action.

2.M.03 Check master cylinder for internal and external leaks and proper operation; determine necessary action.

2.M.04 Remove, bench bleed, and reinstall master cylinder.

2.M.05 Identify poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action.
2.M.06 Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action.
2.M.07 Fabricate and/or install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed.
2.M.08 Select, handle, store, and fill brake fluids to proper level.
2.M.09 Inspect, test, and/or replace components of brake warning light system.
2.M.10 Bleed (manual, pressure, vacuum or surge) brake system.
2.M.11 Flush hydraulic system.

2.N Diagnose and repair drum brake systems.

2.N.01 Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.
2.N.02 Remove, clean (using proper safety procedures), inspect, and measure brake drums; determine necessary action.
2.N.03 Refinish brake drum.
2.N.04 Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.
2.N.05 Remove, inspect, and install wheel cylinders.
2.N.06 Pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings.
2.N.07 Install wheel, torque lug nuts, and make final checks and adjustments.

2.O Diagnose and repair disc brake systems.

2.O.01 Identify poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns.
2.O.02 Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing; determine necessary action.
2.O.03 Clean and inspect caliper mounting and slides for wear and damage; determine necessary action.
2.O.04 Remove, clean, and inspect pads and retaining hardware; determine necessary action.
2.O.05 Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks.
2.O.06 Clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer's recommendations in determining need to machine or replace.
2.O.07 Remove and reinstall rotor.
2.O.08 Refinish rotor according to manufacturer's recommendations.
2.O.09 Adjust calipers equipped with an integrated parking brake system.
2.O.10 Install wheel, torque lug nuts, and make final checks and adjustments.

2.P Diagnose and repair power assist units .

2.P.01 Test pedal free travel with and without engine running; check power assist operation.

2.P.02 Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.
2.P.03 Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action.
2.P.04 Inspect and test hydro-boost system and accumulator for leaks and proper operation; determine necessary action.

2.Q Diagnose and repair miscellaneous brake components and systems (wheel bearings, parking brakes, electrical, etc.).
2.Q.01 Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action.
2.Q.02 Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust wheel bearings.
2.Q.03 Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, or replace as needed.
2.Q.04 Check parking brake operation; determine necessary action.
2.Q.05 Check operation of parking brake indicator light system.
2.Q.06 Check operation of brake stop light system; determine necessary action.
2.Q.07 Replace wheel bearing and race.
2.Q.08 Inspect and replace wheel studs.
2.Q.09 Remove and reinstall sealed wheel bearing assembly.

2.R Diagnose and repair antilock brake and traction control systems.
2.R.01 Identify and inspect antilock brake system (ABS) components; determine necessary action.
2.R.02 Diagnose antilock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment.
2.R.03 Depressurize high-pressure components of the antilock brake system (ABS).
2.R.04 Bleed the antilock brake system's (ABS) front and rear hydraulic circuits.
2.R.05 Remove and install antilock brake system (ABS) electrical/electronic and hydraulic components.
2.R.06 Identify antilock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc).

2.S Diagnose and repair general electrical systems.
2.S.01 Identify and interpret electrical/electronic system concern; determine necessary action.
2.S.02 Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.
2.S.03 Diagnose electrical/electronic integrity for series, parallel and series-parallel circuits using principles of electricity (Ohm's Law).
2.S.04 Use wiring diagrams during diagnosis of electrical circuit problems.
2.S.05 Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems.
2.S.06 Check electrical circuits with a test light; determine necessary action.

2.S.07 Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.
2.S.08 Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.
2.S.09 Check continuity and measure resistance in electrical/electronic circuits and components using an ohmmeter; determine necessary action.
2.S.10 Check electrical circuits using fused jumper wires; determine necessary action.
2.S.11 Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
2.S.12 Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.
2.S.13 Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.
2.S.14 Inspect and test switches, connectors, relays, solid state devices, and wires of electrical/electronic circuits; perform necessary action.
2.S.15 Repair wiring harnesses and connectors.
2.S.16 Perform solder repair of electrical wiring.

2.T Diagnose and repair battery problems.
2.T.01 Perform battery state-of-charge test; determine necessary action.
2.T.02 Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action.
2.T.03 Maintain or restore electronic memory functions.
2.T.04 Inspect, clean, fill, and replace battery.
2.T.05 Perform slow/fast battery charge.
2.T.06 Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed.
2.T.07 Start a vehicle using jumper cables and a battery or auxiliary power supply.

2.U Diagnose and repair starting systems.
2.U.01 Perform starter current draw tests; determine necessary action.
2.U.02 Perform starter circuit voltage drop tests; determine necessary action.
2.U.03 Inspect and test starter relays and solenoids; determine necessary action.
2.U.04 Remove and install starter in a vehicle.
2.U.05 Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.
2.U.06 Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.

2.V Diagnose and repair charging systems.
2.V.01 Perform charging system output test; determine necessary action.
2.V.02 Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.
2.V.03 Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.

2.V.04 Remove, inspect, and install generator (alternator).
2.V.05 Perform charging circuit voltage drop tests; determine necessary action.

2.W Diagnose and repair lighting systems.
2.W.01 Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.
2.W.02 Inspect, replace, and aim headlights and bulbs.
2.W.03 Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action.

2.X Diagnose and repair gauges, warning devices, and driver information systems.
2.X.01 Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action.
2.X.02 Inspect and test sensors, connectors, and wires of electronic instrument circuits; determine necessary action.

2.Y Diagnose and repair horn and wiper/washer systems.
2.Y.01 Diagnose incorrect horn operation; perform necessary action.
2.Y.02 Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.
2.Y.03 Diagnose incorrect washer operation; perform necessary action.

2.Z Diagnose and repair accessories.
2.Z.01 Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action.
2.Z.02 Diagnose incorrect heated glass operation; determine necessary action.
2.Z.03 Diagnose incorrect electric lock operation; determine necessary action.
2.Z.04 Diagnose incorrect operation of cruise control systems; determine necessary action.
2.Z.05 Disarm and enable the airbag system for vehicle service.
2.Z.06 Diagnose radio static and weak, intermittent, or no radio reception; determine necessary action.
2.Z.07 Diagnose body electronic system circuits using a scan tool; determine necessary action.
2.Z.08 Check for module communication errors using a scan tool.

2.AA Diagnose and repair general engine problems.
2.AA.01 Identify and interpret engine performance concern; determine necessary action.
2.AA.02 Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins.
2.AA.03 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).
2.AA.04 Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.

2.AA.05 Identify abnormal engine noise or vibration concerns; determine necessary action.
2.AA.06 Identify abnormal exhaust color, odor, and sound; determine necessary action.
2.AA.07 Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.
2.AA.08 Perform cylinder power balance test; determine necessary action.
2.AA.09 Perform cylinder compression tests; determine necessary action.
2.AA.10 Perform cylinder leakage test; determine necessary action.
2.AA.11 Identify engine mechanical, electrical, electronic, fuel, and ignition concerns with an oscilloscope and/or engine diagnostic equipment.
2.AA.12 Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action.
2.AA.13 Verify engine operating temperature; determine necessary action.
2.AA.14 Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.
2.AA.15 Verify correct camshaft timing.

2.BB Diagnose and repair computerized engine controls.

2.BB.01 Retrieve and record stored OBD I diagnostic trouble codes; clear codes.
2.BB.02 Retrieve and record stored OBD II diagnostic trouble codes; clear codes.
2.BB.03 Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine control system with stored diagnostic trouble codes.
2.BB.04 Identify emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes.
2.BB.05 Check for module communication errors using a scan tool.
2.BB.06 Obtain and interpret scan tool data.
2.BB.07 Access and use service information to perform step-by-step diagnosis.

2.CC Diagnose and repair ignition systems.

2.CC.01 Identify ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with electronic ignition (distributorless) systems.
2.CC.02 Identify ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with distributor ignition (DI) systems.
2.CC.03 Inspect and test ignition primary circuit wiring and solid state components; perform necessary action.
2.CC.04 Inspect, test and service distributor.
2.CC.05 Inspect and test ignition system secondary circuit wiring and components; perform necessary action.

2.CC.06 Inspect and test ignition coil(s); perform necessary action.
2.CC.07 Inspect and test ignition system pick-up sensor or triggering devices; perform necessary action.

2.DD Diagnose and repair fuel, air induction, and exhaust systems.

2.DD.01 Diagnose hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles.
2.DD.02 Identify hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems.
2.DD.03 Inspect and test mechanical and electrical fuel pumps and pump control systems for pressure, regulation and volume; perform necessary action.
2.DD.04 Replace fuel filters.
2.DD.05 Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.
2.DD.06 Check idle speed and fuel mixture.
2.DD.07 Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.
2.DD.08 Perform exhaust system back-pressure test; determine necessary action.

2.EE Diagnose and repair emissions control systems.

2.EE.01 Diagnose oil leaks, emissions, and driveability problems resulting from malfunctions in the positive crankcase ventilation (PCV) system; determine necessary action.
2.EE.02 Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.
2.EE.03 Diagnose emissions and driveability problems caused by malfunctions in the exhaust gas recirculation (EGR) system.
2.EE.04 Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action.
2.EE.05 Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.
2.EE.06 Inspect and test mechanical components of secondary air injection systems; perform necessary action.
2.EE.07 Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.
2.EE.08 Inspect and test catalytic converter performance.
2.EE.09 Inspect and test components of intake air temperature control system; perform necessary action.
2.EE.10 Inspect and test components of early fuel evaporation control system; perform necessary action.

2.EE.11 Identify emissions and driveability problems resulting from malfunctions in the evaporative emissions control system.
2.EE.12 Inspect and test components and hoses of evaporative emissions control system; perform necessary action.
2.EE.13 Interpret evaporative emission related diagnostic trouble codes (DTCs); determine necessary action.
2.EE.14 Adjust valves on engines with mechanical or hydraulic lifters.
2.EE.15 Remove and replace timing belt; verify correct camshaft timing.
2.EE.16 Remove and replace thermostat.
2.EE.17 Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.

Strand 3: Embedded Academic Knowledge and Skills

3.A English Language Arts

VTE #	Acad #	Standard	Grade	Topic
3.A.01c	2.4	Integrate relevant information gathered from group discussions and interviews for reports.	Pre-9th	Language
3.A.02c	13.19	Identify and use knowledge of common graphic features (charts, maps, diagrams).	Pre-9th	Reading
3.A.03c	19.21	Write reports based on research that include quotations, footnotes or endnotes, and a bibliography.	Pre-9th	Composition
3.A.04c	24.4	Apply steps for obtaining information from a variety of sources, organizing information, documenting sources, and presenting research in individual projects.	Pre-9th	Composition
3.A.05c	19.27	For informational/expository writing: Write well-organized research papers that prove a thesis statement using logical organization, effective supporting evidence, and variety in sentence structure.	11/12	Composition
3.A.06c	24.6	Formulate original, open-ended questions to explore a topic of interest, design and carry out research, and evaluate the quality of the research paper in terms of the adequacy of its questions, materials, approach, and documentation of sources.	11/12	Composition
3.A.07c	3.17	Deliver formal presentations for particular audiences using clear enunciation and appropriate organization, gestures, tone, and vocabulary.	11/12	Language
3.A.08c	4.27	Use general dictionaries, specialized dictionaries, thesauruses, histories of language, books of quotations, and other related references as needed.	11/12	Language
3.A.09c		Comprehend and use problem-solving techniques and decision trees that are contained in service manuals and databases to determine cause-and-effect relationships.		Voc

3.A.10c		Interpret charts, tables, or graphs to determine the manufacturer's specifications for systems operation to identify out-of-tolerance systems and subsystems.		Voc
3.A.11c		Read technical manuals, guides, resource books and technical literature to gain information and solve problems (Operator's manual, service manuals and databases etc).		Voc
3.A.12c		Read, comprehend, and follow written technical directions for repairs, procedures and processes. (Shop manuals, etc.).		Voc
3.A.13c		Write warranty reports and work orders to include information regarding problem resolution and the results of the work performed for the customer or manufacturer.		Voc

3.B Mathematics

VTE #	Acad #	Standard	Grade	Topic
3.B.01c	7.G.5	Use a ruler, protractor, and compass to draw polygons and circles.	Pre-9th	Geometry
3.B.02c	7.M.2	Given the formulas, convert from one system of measurement to another. Use technology as appropriate.	Pre-9th	Measurement
3.B.03c	7.P.4	Solve linear equations using tables, graphs, models, and algebraic methods.	Pre-9th	Patterns, relations, algebra
3.B.04c	7.P.6	Use linear equations to model and analyze problems involving proportional relationships. Use technology as appropriate.	Pre-9th	Patterns, relations, algebra
3.B.05c	8.M.2	Given the formulas, convert from one system of measurement to another. Use technology as appropriate.	Pre-9th	Measurement
3.B.06c	8.N.1	Compare, order, estimate, and translate among integers, fractions and mixed numbers (i.e., rational numbers), decimals, and percents.	Pre-9th	Numbers

3.B.07c	10.D.1	Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table, stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.	9/10	Data Analysis, Probability and Statistics
3.B.08c	10.G.10	Demonstrate the ability to visualize solid objects and recognize their projections and cross sections.	9/10	Geometry
3.B.09c	10.G.3	Recognize and solve problems involving angles formed by transversals of coplanar lines. Identify and determine the measure of central and inscribed angles and their associated minor and major arcs. Recognize and solve problems associated with radii, chords, and arcs within or on the same circle.	9/10	Geometry
3.B.10c	10.G.8	Find linear equations that represent lines either perpendicular or parallel to a given line and through a point, e.g., by using the "point-slope" form of the equation.	9/10	Geometry
3.B.11c	10.M.1.	Calculate perimeter, circumference, and area of common geometric figures such as parallelograms, trapezoids, circles, and triangles.	9/10	Measurement
3.B.12c	10.M.2	Given the formula, find the lateral area, surface area, and volume of prisms, pyramids, spheres, cylinders, and cones, e.g., find the volume of a sphere with a specified surface area.	9/10	Measurement
3.B.13c	10.M.4	Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements.	9/10	Measurement
3.B.14c	10.P.8	Solve everyday problems that can be modeled using systems of linear equations or inequalities. Apply algebraic and graphical methods to the solution. Use technology when appropriate. Include mixture, rate, and work problems.	9/10	Patterns, relations, algebra

3.B.15c	G.G.2	Write simple proofs of theorems in geometric situations, such as theorems about congruent and similar figures, parallel or perpendicular lines. Distinguish between postulates and theorems. Use inductive and deductive reasoning, as well as proof by contradiction. Given a conditional statement, write its inverse, converse, and contrapositive.	9/12	Geometry
3.B.16c	12.D.1	Design surveys and apply random sampling techniques to avoid bias in the data collection.	11/12	Data Analysis, Probability and Statistics
3.B.17c	12.D.2	Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.	11/12	Data Analysis, Probability and Statistics
3.B.18c	12.D.5	Describe a set of frequency distribution data by spread (variance and standard deviation), skewness, symmetry, number of modes, or other characteristics. Use these concepts in everyday applications.	11/12	Data Analysis, Probability and Statistics
3.B.19c	12.D.6	Use combinatorics (e.g., "fundamental counting principle," permutations, and combinations) to solve problems, in particular, to compute probabilities of compound events. Use technology as appropriate.	11/12	Data Analysis, Probability and Statistics
3.B.20c	12.D.7	Compare the results of simulations (e.g., random number tables, random functions, and area models) with predicted probabilities.	11/12	Data Analysis, Probability and Statistics
3.B.21c	12.G.5	Apply properties of angles, parallel lines, arcs, radii, chords, tangents, and secants to solve problems.	11/12	Geometry
3.B.22c	12.M.1	Describe the relationship between degree and radian measures, and use radian measure in the solution of problems, in particular, problems involving angular velocity and acceleration.	11/12	Measurement
3.B.23c	12.M.2	Use dimensional analysis for unit conversion and to confirm that expressions and equations make sense.	11/12	Measurement

3.B.24c	12.P.11	Solve everyday problems that can be modeled using polynomial, rational, exponential, logarithmic, trigonometric, and step functions, absolute values, and square roots. Apply appropriate graphical, tabular, or symbolic methods to the solution. Include growth and decay; joint (e.g., $I = Prt$, $y = k(w_1 + w_2)$) and combined ($F = G(m_1m_2)/d^2$) variation, and periodic processes.	11/12	Patterns, relations, algebra
3.B.25c	12.P.7	Find solutions to quadratic equations (with real coefficients and real or complex roots) and apply to the solutions of problems.	11/12	Patterns, relations, algebra
3.B.26c	12.P.8	Solve a variety of equations and inequalities using algebraic, graphical, and numerical methods, including the quadratic formula; use technology where appropriate. Include polynomial, exponential, logarithmic, and trigonometric functions; expressions involving absolute values; trigonometric relations; and simple rational expressions.	11/12	Patterns, relations, algebra
3.B.27c	12.P.9	Use matrices to solve systems of linear equations. Apply to the solution of everyday problems.	11/12	Patterns, relations, algebra
3.B.28c		Apply mathematical operations and processes to determine conformance with the manufacturer's specifications for location, proportion, mixture, system and sub-system analysis, alignment, etc.		Voc
3.B.29c		Compute mentally whether the observed measurement is out-of-tolerance when comparing the observed measurement to the manufacturer's specifications.		Voc
3.B.30c		Determine the proper sequence of arithmetic operations that are needed to arrive at a solution that can be compared to other specifications when comparing system measurements or tolerances to the manufacturer's specifications and apply them.		Voc
3.B.31c		Measure and/or test with tools designed for English or metric measurements, then convert the result to the manufacturers system used for specifying the correct measurement or tolerance.		Voc

3.B.32c		Solve problems that involve determining whether the proportion of the existing volume or mixture compares to the manufacturers specifications and is within the recommended tolerance.		Voc

3.C Science and Engineering/Technology

VTE #	Acad #	Standard	Grade	Topic
3.C.01c	1	Differentiate between weight and mass, recognizing that weight is the amount of gravitational pull on an object.	Pre-9th	Physical
3.C.02c	3	Recognize that the measurement of volume and mass requires understanding of the sensitivity of measurement tools (e.g., rulers, graduated cylinders, balances) and knowledge and appropriate use of significant digits.	Pre-9th	Physical
3.C.03c	5.5	Calculate mass-mass, mass-volume, volume-volume, and limiting reactant problems for chemical reactions. (as they relate to compounds used in an automobile).		Chemistry
3.C.04c	6.2	Explain the relationship between temperature and average kinetic energy.		Chemistry
3.C.05c	6.6	Use the combined gas law to determine changes in pressure, volume, or temperature.		Chemistry
3.C.06c	11.1	Describe the chemical processes known as oxidation and reduction.		Chemistry
3.C.07c	11.5	Explain how a typical battery, such as a lead storage battery or a dry cell, works.		Chemistry
3.C.08c	1.1	Identify and explain the steps of the engineering design process, i.e., identify the problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.		Eng/Tech

3.C.09c	3.1	Differentiate between open (e.g., irrigation, forced hot air system) and closed (e.g., forced hot water system, hydroponics) fluid systems and their components such as valves, controlling devices, and metering devices.		Eng/Tech
3.C.10c	3.2	Identify and explain sources of resistance (e.g., 45deg. elbow, 90deg. elbow, type of pipes, changes in diameter) for water moving through a pipe.		Eng/Tech
3.C.11c	3.3	Explain the relationship among temperature change in a substance for a given amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.		Eng/Tech
3.C.12c	3.4	Differentiate between hydraulic and pneumatic systems and provide examples of appropriate applications of each as they relate to manufacturing and transportation systems.		Eng/Tech
3.C.13c	3.6	Solve problems related to hydrostatic pressure and depth in fluid systems.		Eng/Tech
3.C.14c	4.1	Differentiate among conduction, convection, and radiation in a thermal system, e.g., heating and cooling systems.		Eng/Tech
3.C.15c	4.2	Give examples of how conduction, convection, and radiation are used in the selection of materials, e.g., home and vehicle thermostat designs, circuit breakers.		Eng/Tech
3.C.16c	4.4	Explain how environmental conditions influence heating and cooling of buildings and automobiles.		Eng/Tech
3.C.17c	4.5	Identify and explain the tools, controls, and properties of materials used in a thermal system, e.g., thermostats, R Values, thermal conductivity, temperature sensors.		Eng/Tech

3.C.18c	5.2	Identify and explain the components of a circuit including a source, conductor, load, and controllers (controllers are switches, relays, diodes, transistors, integrated circuits).		Eng/Tech
3.C.19c	5.3	Explain the relationship between resistance, voltage, and current (Ohm's Law).		Eng/Tech
3.C.20c	5.4	Determine the voltages and currents in a series circuit and a parallel circuit.		Eng/Tech
3.C.21c	5.5	Explain how to measure voltage, resistance, and current in electrical systems.		Eng/Tech
3.C.22c	5.6	Describe the differences between Alternating Current (AC) and Direct Current (DC).		Eng/Tech
3.C.23c	7.2	Differentiate the selection of tools and procedures used in the safe production of products in the manufacturing process, e.g., hand tools, power tools, computer-aided manufacturing, three-dimensional modeling.		Eng/Tech
3.C.24c	1.3	Distinguish between, and solve problems involving, velocity, speed, and constant acceleration.		Physics
3.C.25c	1.4	Create and interpret graphs of motion (position vs. time, speed vs. time, velocity vs. time, constant acceleration vs. time).		Physics
3.C.26c	1.9	Qualitatively distinguish between static and kinetic friction, what they depend on and their effects on the motion of objects. *(apply lubrication principles to the reduction of friction, voc)*.		Physics
3.C.27c	1.12	Identify appropriate standard international units of measurement for force, mass, distance, speed, acceleration, and time, and explain how they are measured.		Physics
3.C.28c	2.4	Describe the relationship among energy, work, and power both conceptually and quantitatively.		Physics
3.C.29c	2.5	Interpret the law of conservation of momentum and provide examples that illustrate it.		Physics

		Calculate the momentum of an object.		
3.C.30c	2.6	Identify appropriate standard international units of measurement for energy, work, power, and momentum.		Physics
3.C.31c	3.2	Differentiate between specific heat and heat capacity.		Physics
3.C.32c	3.3	Explain the relationship among temperature change in a substance for a given amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.		Physics
3.C.33c	3.4	Recognize that matter exists in four phases, and explain what happens during a phase change.		Physics
3.C.34c	5.5	Identify appropriate units of measurement for current, voltage, and resistance, and explain how they are measured.		Physics
3.C.35c		Describe electromagnetism coil and explain electromagnetism magnetic fields and forces.		Voc
3.C.36c		State and explain the application of Pascal's law.		Voc
3.C.37c		Describe force torque.		Voc
3.C.38c		Describe viscosity.		Voc
3.C.39		Describe the chemical reactions occurring in combustion, convection, and contamination in a given system.		Voc
3.C.40		Explain material reactions that cause expansion and contraction of system parts due to chemical, heat, or atmospheric influences.		Voc
3.C.41		Explain the effect that heat has on the state of matter.		Voc
3.C.42		Describe the material composition of insulation and the physical principles behind the use of insulation for sound and heat control.		Voc

3.C.43		Identify the types of vibrational waves (centrifugal and torque) and the effect they have on parts and components of a vehicle.		Voc
3.C.44		Explain how chemical reactions that occur in a contaminated liquid can cause deterioration.		Voc
3.C.45		Explain how rotational motion is changed to linear motion affecting rotating systems (toe-out, tracking).		Voc
3.C.46		Explain how variances in flow rate in air flow sensors or cooling systems can affect engine performance.		Voc
3.C.47		Explain and describe the operations and functions of mechanical components in simple machines (levers, pulleys, gears, etc).		Voc

Strand 4: Employability Knowledge and Skills

4.A Develop employability skills to secure and keep employment in chosen field.

- 4.A.01a Evaluate industries, organizations, and careers based on multiple sources of research and information.
- 4.A.02a Assess interest areas to determine potential career pathways, including career ladders.
- 4.A.03a Develop a career plan with alternatives.
- 4.A.04a Complete job applications and related employment documents (e.g. W-4).
- 4.A.05a Create professional cover letters, resumes, and portfolios in a variety of formats (print and electronic) .
- 4.A.06a Apply job search skills to seek, evaluate, apply for, and accept employment.
- 4.A.07a Explain good interviewing skills.
- 4.A.08a Demonstrate employability skills needed to get and keep a job.
- 4.A.09a Assess alternative occupational choices (e.g. working conditions, benefits, and opportunities to change).

Performance Examples:

1. Research positions open within a variety of companies and compare/contrast their descriptions, duties, and expectations.
2. Prepare responses to standard interview questions.
3. Participate in a mock-interview with industry professionals.

4.B Communicate in multiple modes to address needs within the career and technical field.

- 4.B.01a Apply strategies to enhance effectiveness of all types of communications in the workplace.
- 4.B.02a Apply reading skills and strategies to work-related documents.
- 4.B.03a Locate information from books, journals, magazines, and the Internet.
- 4.B.04a Apply basic writing skills to work-related communication.
- 4.B.05a Write work-related materials.
- 4.B.06a Explain information presented graphically.
- 4.B.07a Use writing/publishing/presentation applications.
- 4.B.08a Apply basic skills for work-related oral communication.
- 4.B.09a Explain proper telephone etiquette and skills.
- 4.B.10a Lead formal and informal group discussions.
- 4.B.11a Demonstrate effective negotiation and conflict management.
- 4.B.12a Apply active listening skills to obtain and clarify information.
- 4.B.13a Communicate with others in a diverse workforce.

Performance Examples:

1. Review a professional journal; choose one article to summarize.
2. Call the publisher for free products in journal.
3. Develop an oral presentation regarding an article in a journal.
4. Summarize trends presented in a graph.

4.C Solve problems using critical thinking.

- 4.C.01a Demonstrate skills used to define and analyze a given problem.
- 4.C.02a Explain the importance and dynamics of individual and teamwork approaches of problem solving.
- 4.C.03a Describe methods of researching and validating reliable information relevant to the problem.
- 4.C.04a Explain strategies used to formulate ideas, proposals and solutions to problems.
- 4.C.05a Select potential solutions based on reasoned criteria.
- 4.C.06a Implement and evaluate solution(s).

4.D Demonstrate positive work behaviors.

- 4.D.01a Identify time management and task prioritization skills.
- 4.D.02a Explain the importance of following workplace etiquette/protocol.
- 4.D.03a Demonstrate willingness to learn and further develop skills.
- 4.D.04a Demonstrate self-management skills.
- 4.D.05a List causes of stress and effective stress management techniques.
- 4.D.06a Describe the importance of having a positive attitude and techniques that boost morale.
- 4.D.07a Show initiative by coming up with unique solutions and taking on extra responsibilities.
- 4.D.08a Explain the importance of setting goals and demonstrate the ability to set, reach, and evaluate goals.
- 4.D.09a Explain the importance of taking pride in work accomplished and extrinsic and intrinsic motivators that can be used to increase pride.
- 4.D.10a Value the importance of professionalism, including reliability, honesty, responsibility, and ethics.
- 4.D.11a Demonstrate a respect for diversity and its benefit to the workplace.

Strand 5: Management and Entrepreneurship Knowledge and Skills

5.A Analyze basic business practices required to start and run a company/organization.

5.A.01a Define entrepreneurship.
5.A.02a Describe the relationship between suppliers, producers, and consumers.
5.A.03a Compare and contrast types of businesses, including sole proprietorships, small businesses, companies, corporations, governmental agencies, and non-profit organizations.
5.A.04a Describe practices that ensure quality customer service.
5.A.05a Explain the value of competition in business/field.

Performance Examples:

1. Prepare a business plan for a new company in your community.
2. Participate in a discussion with members of a local small-business incubator or chamber of commerce, identifying opportunities and summarizing best practices of new companies.
3. Create an equipment list, with costs, of equipment required for doing specific tasks.
4. Identify local zoning and environmental laws that apply to businesses in your industry.

5.B Manage all resources related to a business/organization.

5.B.01a Identify a company's/organization's chain of command and organizational structure.
5.B.02a Define and demonstrate leadership and teamwork skills.
5.B.03a Explain ways a company or organization can market itself, including choosing a name, designing logos and promotional materials, advertising, and the importance of word-of-mouth.
5.B.04a Identify methods to track inventory, productivity, income, expenses, and personnel .
5.B.05a Explain the importance of written operating procedures and policies.
5.B.06a Identify professional organizations and their benefits.
5.B.07a Explain methods to effectively run a meeting.

Performance Examples:

1. Create a plan to keep track of tools and supplies in your classroom/shop.
2. Work as a team to complete a project, including running and participating in problem-solving meetings.
3. Contact a relevant professional organization and request information about its benefits, membership requirements, and costs.
4. Clip print advertisements from local companies, identifying common themes and contrasting different styles.

5.C Describe methods for managing, organizing, retrieving and reporting financial data.

5.C.01a Explain the role of small businesses in the economy.
5.C.02a Extract and extrapolate data from financial documents, such as a pay-stub, budget, tax statement, and financial report.

Performance Examples:
1. Create and follow a budget for an in-class project.
2. Identify equipment in your shop/lab that are considered as capital.
3. From a pay-stub, determine gross salary, deductions, and net pay for a calendar year.
4. Create a rate card or other list of standardized costs for services provided, based on research of local rates and practices.

5.D Apply labor and civil rights law and guidelines to business practice and decisions.

5.D.01a List federal and state mandated employee rights.
5.D.02a Describe proper working conditions for your industry.
5.D.03a Explain the role of labor organizations.
5.D.04a Discuss the importance of diversity and list methods of encouraging diversity in the workplace.
5.D.05a Describe standard forms of employment contracts applicable to your industry.
5.D.06a State the current minimum wage, as well as wages for common jobs found within the field.
5.D.07a List opportunities for continual professional development.

Performance Examples:
1. Participate in and summarize a discussion with a member of a labor organization.
2. Participate in and summarize a discussion with a member of a civil rights organization.
3. While participating in a group project, write and follow job descriptions for each member of the team.
4. Evaluate a shop/lab in terms of safety, ergonomics, and workflow.

5.E Evaluate the effects of community relations on companies and the industry.

5.E.01a Describe the role that the industry/organization plays in different communities.
5.E.02a Describe the role that community interests play in a company's/organization's decision-making process.

Performance Example:
1. Participate in a service project or community-centered event.

5.F Apply legal requirements and ethical considerations to business practice and decisions.

5.F.01a Identify laws that regulate businesses/organizations in your field.
5.F.02a Define the requirements for and protections given by copyright and trademark law.
5.F.03a Define the impact of the Americans with Disabilities Act and other civil rights legislation on your business/organization, employees, and customers.
5.F.04a Define ethical business practices for your field.
5.F.05a Identify trade-specific practices that support clean energy technologies and encourage environmental sustainability

5.F.06c Express a sense of personal obligation to each individual customer and his or her vehicle.
5.F.07c Exercise care for the customer's property while in your possession.
5.F.08c Repair the vehicle with the highest regard for the environment.
5.F.09c Promote and foster goodwill between the repair industry and customers.
5.F.10c Recommend corrective and maintenance services, explaining to the customer which of these are required to correct existing problems and which are for preventative maintenance.
5.F.11c Create a price estimate for work to be performed.
5.F.12c Explain legal standards regarding estimates, as established by the Commonwealth of Massachusetts Attorney General's Office.
5.F.13c Create an itemized invoice which clearly identifies any used or remanufactured parts.
5.F.14c Explain the importance of using merchandise meeting or exceeding the original manufacturers' standards.
5.F.15c Discuss offering warranties covering parts or services.
5.F.16c Identify the importance of obtaining prior authorization for all work performed.
5.F.17c List ways to notify the customer if appointments or completion promises cannot be kept.
5.F.18c Explain and identify ways to follow the Certified Technician's Code of Ethics published by the ASE: Automotive Service Excellence.
5.F.19c Explain and identify ways to follow the Auto Sales and Repair Regulations of the Massachusetts Attorney General.

Performance Examples:

1. Research the ethical guidelines set forth by a professional organization related to your industry and participate in a debate over how to apply these guidelines to a variety of situations.
2. Create a portfolio of a variety of completed contracts and their uses.
3. Participate in and summarize a discussion with a lawyer, consumer advocate, or other legal professionals.
4. Create a quick reference outline listing legal topics and related resources.

Strand 6: Technological Knowledge and Skills

6.A Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.

- 6.A.01a Select and utilize the appropriate technology to solve a problem or complete a task.
- 6.A.02a Demonstrate file management skills (e.g., install new software, compress and expand files as needed, download files as appropriate).
- 6.A.03a Differentiate between different operating systems and demonstrate use of at least one to open and switch between programs and files.
- 6.A.04a Identify and demonstrate resolutions to simple hardware and software problems as they occur (e.g., frozen screen, disk error, printing problems).
- 6.A.05a Save, retrieve, load, format, and import data into, and export a variety of electronic documents (word processing, spreadsheet, database, AND desktop publishing).
- 6.A.06a Demonstrate the proper use of a variety of external peripherals and how they connect to a computer.
- 6.A.07a Illustrate methods of selecting and using search engines.
- 6.A.08a Send, receive, and manage electronic correspondence and files, in accordance with school policy.
- 6.A.09a Demonstrate proper use of electronic proofreading tools and explain reasons why these shouldn't be relied upon solely.

Performance Example:

1. In the development of work-based projects, students demonstrate computer skills inherent in the word processing techniques used, the organization of data, use of photographic representation, research projects, and other relevant project based activities.

6.B Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media.

- 6.B.01a Identify ways in which technology is used in the workplace and in society.
- 6.B.02a Summarize the rights and responsibilities of the school's Acceptable Use Policy.
- 6.B.03a Explain laws restricting use of copyrighted materials on the Internet.
- 6.B.04a Discuss the concerns about electronic communications, privacy and security, including protection from spyware and viruses.

Performance Example:

1. Describe how computers are used to increase efficiency, accuracy, and professionalism in the industry.

6.C Demonstrate ability to use technology for research, problem solving, and communication.

- 6.C.01a Locate, evaluate, collect, and process information from a variety of electronic sources.
- 6.C.02a Demonstrate the use of telecommunications and other media to interact or collaborate with peers, experts, and other audiences.

6.C.03a	Demonstrate the use of appropriate electronic sources to conduct research (e.g., Web sites, online periodical databases, and online catalogs).
6.C.04a	Demonstrate proper style (with correct citations) when integrating electronic research results into a research project.
6.C.05a	Collect, organize, analyze, and graphically present data using the most appropriate tools.
6.C.06a	Present information, ideas, and results of work using any of a variety of communications technologies (e.g., multimedia presentations, Web pages, videotapes, desktop-published documents).
6.C.07a	Identify capabilities of technology resources and describe how they can be used for lifelong learning.
6.C.08a	Demonstrate the proper use of electronic tools and office communications equipment (telephone, fax, copier, etc).

Performance Example:

1. Student is able to effectively use various technologies in the workplace.