School District of Marshfield Course Syllabus

Course Name: Automotive Technology
Length of Course: 1 Year
Credit: 1

Program Goal(s):

Empower learners to be college and career ready through standards-based experiences in the classroom and career-based learning experiences with business and industry partners. Learners will engage through technology in design, building, problem-solving, repair or service, in a collaborative environment through theory and hands-on experiences.

Course Description:

Automotive Technology is a laboratory based course designed to introduce you to automotive maintenance, repair, and beginning diagnosing. The first semester will include automotive maintenance, basic systems repair, online service manuals, cooling, starting, and charging systems. During the second semester, the student will learn about fuel, ignition, brake, steering, and suspension systems and be introduced to basic scan tool operation.

Standards:

Wisconsin Technology & Engineering – Broad Based (BB)		
Standard	**Learning Priority**	**Performance Indicators**
BB1: Students will analyze the core concepts of technology	BB1.a Analyze and use technological systems	BB1.a.5.h Describe how systems can fail because of design flaws, defect parts, poorly matched parts

		or they were used beyond their design capabilities BB1.a.6.h Describe how the outputs of one subsystem given a prominent energy, power and transportation system
	BB1.b Analyze and use tools and materials.	BB1.b.5.h Select appropriate resources and explain how trade-offs between completing values, such as availability, cost, desirability and waste influenced their decision. BB1.b.6.h Choose and perform the material processing operations of forming (e.g., bending, pressing, drawing, rolling), bonding (e.g., gluing, soldering, brazing, spot welding, gas welding, arc welding), fastening (e.g., screws, nuts & bolts, rivets, clips, pins, nails) and finishing (e.g., surface preparation, cleaning, treatment, coating).
	BB1.d Analyze and use electricity and electronic systems.	BB1.d.5.h Describe the role of thermal, optical, and mechanical transducers in sending electrical control signals to modify how a system performs. BB1.d.6.h Perform a voltage drop test and describe the relationship between voltage, current, and resistance with a multimeter. BB1.d.7.h Inspect and test components such as switches, connectors, relays, and solid state devices and conductors and take appropriate action.
	BB1.e Analyze, explain, and use control systems.	BB1.e.6.h Select and perform appropriate maintenance is the process in order for the product or system to continue functioning properly, to extend its life or to upgrade its capability given a flawed product or system.
Wisconsin Technology & Engineering – Electronics (EL)		
Standard	**Learning Priority**	**Performance Indicators**
EL1: Students will develop, use, and apply basic electronics and electricity concepts.	EL1.a Apply electronic theory to practice.	EL1.a.13.h Calculate current, voltage, or resistance using Ohm's Law and Kirchoff's Voltage Law.
EL2: Students will develop the ability to use symbols, measurements and schematics to build, test, and troubleshoot.	EL2.a Construct and measure a basic circuit using electronic components.	EL2.a.8.h Explain the basic operation of the following electronic components: Capacitors, Resistors, Diodes, Transistors, Insulators, Conductors, Switches, Fuses, Circuit Breakers, Batteries, and Power Supplies.

		EL2.a.9.h Recognize the following electronic components by constructing simple circuits: Capacitors, Resistors, Diodes, Transistors, Insulators, Conductors, Switches, Fuses, Circuit Breakers, Batteries, and Power Supplies. EL2.a.10.h Demonstrate multimeter and usage. EL2.a.12.h List types of solder and reasons for choosing each.
	EL2.b Demonstrate electronic measurement to series, parallel, and combination circuits.	EL2.b.5.h Explain how a series circuit is used in DC electronic equipment. EL2.b.6.h Calculate an unknown current, voltage, or resistance in a series circuit using Ohm's Law. EL2.b.7.h Explain how a parallel circuit is used in DC electronic equipment. EL2.b.8.h Calculate an unknown current, voltage, or resistance in a parallel circuit using Ohm's Law. EL2.b.10.h Explain multimeter construction, components, and usage, and distinguish between digital and analog meters.
EL7: Demonstrate safe and appropriate use of tools, machines, and materials in electronics technology.	EL7.a Demonstrate, apply, and measure electronic safety concepts applied to circuits.	EL7.a.6.h Demonstrate the safe usage of appropriate tools, procedures, and operation of equipment. EL7.a.7.h Describe personal safety precautions for working with electric and electronic devices electrical shock.
Wisconsin Technology & Engineering – Power and Energy (PE)		
Standard	**Learning Priority**	**Performance Indicators**
PE1: Students will be able to select and use energy and power systems.	PE1.b Analyze, use, and discuss machine and tool use relating to energy and power systems.	PE1.b.11.h Demonstrate and follow proper safety procedures for tools and machines used in power and energy systems. PE1.b.12.h Demonstrate the practical and theoretical applications of test equipment to identify voltage, current, and resistance in energy systems.
Wisconsin Technology & Engineering – Transportation Standards (TR)		
Standard	**Learning Priority**	**Performance Indicators**
TR1: Students will be able to select and use transportation technologies.	TR1.a Analyze and explain transportation systems.	TR1.a.6.h Summarize how transportation plays a vital role in the operation of other technologies, such as manufacturing, construction, communication, health and safety and agriculture.

		TR1.a.7.h Identify joe government regulations and technological trade-offs might influence the transportation modes used to move people and goods from one place to another. TR1.8.h Relate how the current and future design of advanced transportation systems depends on many innovative materials and processes.
	TR1.b Analyze and explain how transportation vehicles and transportation vehicle systems work.	TR1.b.7.h Interpret preventive maintenance schedules and recommended service intervals for vehicles. TR1.b.8.h Define the interdependency of individual systems within a vehicle. TR1.b.9.h Explain that all systems demand specific repair procedures in order to achieve the highest performance and efficiency.
	TR1.c Develop he skill set necessary to diagnose, problem solve and repair transportation vehicles.	TR1.c.9.h Develop measurement skills in electrical/ electronic, mechanical and hydraulic applications that are necessary to efficiently repair vehicles. TR1.c.10.h Students will perform tasks related directly to current national standards per transportation area (i.e., NATEF). TR1.c.11.h Demonstrate safe and proficient use of specialty tools and equipment related to servicing transportation vehicles. Tr1.c.12.h Explain career preparation, career pathways and the importance of on-the-job training as well as further education with regard to the transportation field.
Wisconsin Common Career Technical Standards (WCCTS)-Creativity, Critical Thinking, Communication and Collaboration (C)		
Standard	**Learning Priority**	**Performance Indicators**
Standard: 4C1: Students will think and work creatively to develop innovative solutions to problems and opportunities.	4C1.a: Develop original solutions, products and services to meet a given need.	4C1.a.4.m: Analyze elements of a problem to develop creative solutions. 4C1.a.6.m: Describe how past experiences can inform current problem solving. 4C1.a.7.h: Develop original ways to solve a given problem. 4C1.a.8.h: Design a product or service that could fulfill a human need or desire.

		4C1.a.9.h: Apply past experiences to current problems in developing innovative solutions.
	4C1.b: Work creatively with others to develop solutions, products and services.	4C1.b.4.m: Explain how multiple people can develop better solutions than an individual. 4C1.b.5.m: Explain how multiple people and perspectives can develop better ideas than an individual. 4C1.b.6.m: Explain how multiple people and perspectives can improve an existing product or process better than an individual. 4C1.b.7.h: Incorporate the skills and experiences of others to develop a new solution to a problem. 4C1.b.8.h: Work as part of a team to design a product or service that could fulfill a human need or desire. 4C1.b.9.h: Work as part of a team to improve an existing product or process.
Standard: 4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills.	4C2.a: Develop effective resolutions for a given problem, decision or opportunity using available information.	4C2.a.5.m: Analyze symptoms to identify the root cause of a problem. 4C2.a.6.m: Develop multiple resolutions for a given problem, decision or opportunity. 4C2.a.7.m: Identify problems that became worse due to poorly thought out or poorly informed solutions. 4C2.a.8.m: Explain how implementation of a solution or action may affect one or more corresponding systems. 4C2.a.9.m: Explain how different resolutions may be appropriate under different circumstances. 4C2.a.10.m: Explain the process for choosing an action or making a decision. 4C2.a.11.h: Determine the information needed to address an identified problem. 4C2.a.12.h: Contrast the benefits and drawbacks of various proposed resolutions to a given situation. 4C2.a.13.h: Predict how an action could result in unintended consequences, both positive and negative.

		4C2.a.14.h: Analyze the impact of a decision using a systems thinking model. 4C2.a.15.h: Determine the best resolution for a problem, decision or opportunity based on given criteria. 4C2.a.16.h: Defend an action taken or a decision implemented.
	4C2.b: Develop and implement a resolution for a new situation using personal knowledge and experience.	4C2.b.3.m: Analyze problems to determine what past experiences might be related and relevant. 4C2.b.4.m: Analyze a problem to determine how it relates to existing knowledge. 4C2.b.5.h: Apply past experience to develop a course of action for a new situation. 4C2.b.6.h: Use existing knowledge to develop a resolution for a new situation, problem or opportunity.
Standard: 4C3: Students will communicate and collaborate with others to accomplish tasks and develop solutions to problems and opportunities.	4C3.a: Communicate thoughts and feelings with others using verbal and non-verbal language.	4C3.a.8.m: Implement effective listening skills in resolving a situation. 4C3.a.9.h: Develop a mutually acceptable response to a question or problem. 4C3.a.11.h: Communicate effectively in the presence of a language barrier. 4C3.a.12.h: Utilize effective listening skills in creating consensus in a group.
	4C3.b: Work collaboratively with others.	4C3.b.4.m: Use idea generating practices as part of a group. 4C3.b.5.m: Describe ways to facilitate group collaboration. 4C3.b.6.m: Demonstrate the use of various tools to communicate effectively with an individual or a group. 4C3.b.7.h: Participate in group processes to generate consensus. 4C3.b.8.h: Lead group processes to generate consensus.
	4C3.c: Use interpersonal skills to resolve conflicts with others in an ethical manner.	4C3.c.5.m: Contribute to resolving conflicts that occur within a team or group. 4C3.c.6.m: Explore the ethical considerations of a current or historical action or decision. 4C3.c.7.h: Resolve conflicts productively with individuals as they arise.

		4C3.c.8.h: Lead a team or group through a conflict resolution process to reach a productive outcome.
Wisconsin Common Career Technical Standards (WCCTS) – Career Development (CD)		
Standard	**Learning Priority**	**Performance Indicators**
CD1: Students will consider, analyze and apply an awareness of self, identity and culture to identify skills and talents.	CD1.a: Identify person strengths, aptitudes and passions.	CD1.a.3.h: Evaluate various occupations and career pathways to identify personal, academic and career goals based on personal strengths, aptitudes and passions.
	CD1.b: Demonstrate effective decision-making, problem solving and goal setting.	CD1.b.3.m: Develop effective coping skills for dealing with problems. CD1.b.5.h: Use a decision-making and problem-solving model. CD1.b.6.h: Develop an action plan to set and achieve realistic goals.
	CD1.c: Interact effectively with others in similar and diverse teams.	CD1.c.5.m: Distinguish between appropriate and inappropriate behavior in a team setting. CD1.c.7.m: Display cooperative behavior and identify personal strengths and assets in groups.
CD2: Students will identify the connection between educational achievement and work opportunities in order to reach personal and career goals.	CD2.b: Assess attitudes and skills that contribute to successful learning in school and across the life span.	CD2.b.6.m: Research local and regional labor market and job growth information to analyze career opportunities. CD2.b.8.h: Assess education and training opportunities to acquire new skills necessary for career advancement.
CD3: Students will create and manage a flexible and responsive individualized learning plan to meet their career goals.	CD3.b: Examine and evaluate opportunities that could enhance life and career plans and articulate plan to guide decisions and actions.	CD3.b.2.m: Describe educational levels (e.g., work-based learning, certificate, two-year, four-year and professional degrees) and performance skills needed to attain personal and career goals. CD3.b.3.m: Demonstrate openness to exploring a wide range of occupations and career pathways. CD3.b.5.h: Evaluate the relationship between educational achievement and career development.
	CD3.c: Employ career management strategies to achieve future career success and satisfaction.	CD3.c.3.m: Identify work values and needs. CD3.c.6.h: Discuss how adaptability and flexibility, especially when initiating or responding to change, contributes to career success.
CD4: Students will identify and apply employability skills.	CD4.a: Identify and demonstrate positive work behaviors and	CD4.a.3.m: Demonstrate self-discipline, self-worth, positive attitude and integrity.

	personal qualities needed to be employable.	CD4.a.4.m: Demonstrate flexibility and willingness to learn new knowledge and skills.
	CD4.b: Demonstrate skills related to seeking and applying for employment to find and obtain a desired job.	CD4.b.4.m: Compare and contrast personal attributes with employment needs and trends. CD4.b.6.h: Prepare a resume, cover letter, employment application.
	CD4.c: Identify and exhibit traits for retaining employment.	CD4.c.2.m: Demonstrate the behavior and etiquette appropriate to interactions with adults. CD4.c.3.m: Distinguish between appropriate behaviors in a social vs. professional setting. CD4.c.4.h: Model behaviors that demonstrate reliability and dependability. CD4.c.5.h: Maintain appropriate dress and behavior for the job to contribute to a safe and effective workplace/jobsite.
Wisconsin Common Career Technical Standards – Environment, Health, and Safety (EHS)		
Standard	**Learning Priority**	**Performance Indicators**
EHS1: Students will identify the importance and interrelationships of health, safety and environmental systems and evaluate the impacts of these systems on organizational performance for continuous improvement.	EHS1.d: Implement personal and jobsite safety rules and regulations to maintain and improve safe and healthful working conditions and environments.	EHS1.d.5.m: Recognize and use systems in school and in the community that protect and enhance personal, environmental health and safety. EHS1.d.8.h: Identify different workplace systems that protect and enhance personal and environmental health and safety.
National Automotive Technicians Education Foundation (NATEF)		
ASE Area	**Category**	**Task**
I. Engine Repair	A. General	1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. 2. Verify operation of the instrument panel engine warning indicators. 3. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
	C. Lubrication and Cooling Systems	1. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core, and galley plugs; determine necessary action.

		2. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. 3. Remove, inspect, and replace thermostat and gasket/seal. 4. Inspect and test coolant; drain and recover coolant; flush and refill cooling system; use proper fluid type per manufacturer specification; bleed air as required. 5. Perform engine oil and filter change; use proper fluid type per manufacturer specification; reset maintenance reminder as required. 6. Identify components of the lubrication and cooling systems.
II. Automotive Transmission and Transaxle	A. General	1. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. 2. Check fluid level in a transmission or a transaxle equipped with a dip-stick. 3. Check fluid level in a transmission or a transaxle not equipped with a dip-stick. 4. Check transmission fluid condition; check for leaks. 5. Identify drive train components and configuration.
	B. In-Vehicle Transmission/ Transaxle	2. Inspect for leakage at external seals, gaskets, and bushings.
III. Manual Drive Train and Axles	A. General	1. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. 3. Check fluid condition; check for leaks. 4. Identify manual drive train and axle components and configuration.
	B. Clutch	1. Check and adjust clutch master cylinder fluid level; use proper fluid type per manufacturer specification 2. Check for hydraulic system leaks.
	D. Manual Drive Train and Axles	4. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification.
	E. Differential Case Assembly	2. Check and adjust differential case fluid level; use proper fluid type per manufacturer specification.

		3. Drain and refill differential housing. 4. Inspect and replace drive axle wheel studs.
IV. Suspension and Steering Systems	A. General	1. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. 2. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation. 3. Identify suspension and steering system components and configurations.
	B. Related Suspension and steering Service	1. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots. 2. Inspect power steering fluid level and condition. 4. Inspect for power steering fluid leakage. 5. Remove, inspect, replace, and/or adjust power steering pump drive belt. 7. Inspect pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper. 8. Inspect tie rod ends (sockets), tie rod sleeves, and clamps. 9. Inspect upper and lower control arms, bushings, and shafts. 10. Inspect and replace rebound bumpers. 11. Inspect track bar, strut rods/radius arms, and related mounts and bushings. 12. Inspect upper and lower ball joints (with or without wear indicators). 13. Inspect suspension system coil springs and spring insulators (silencers). 14. Inspect suspension system torsion bars and mounts. 15. Inspect and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links. 16. Inspect, remove, and/or replace strut cartridge or assembly; inspect mounts and bushings. 17. Inspect front strut bearing and mount.

		18. Inspect rear suspension system lateral links/arms (track bars), control (trailing) arms. 19. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts. 20. Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings.
	C. Wheel Alignment	2. Describe alignment angles (camber, caster and toe)
	D. Wheel and Tires	1. Inspect tire condition; identify tire wear patterns; check for correct tire size, application (load and speed ratings), and air pressure as listed on the tire information placard/label. 2. Rotate tires according to manufacturer's recommendations including vehicles equipped with tire pressure monitoring systems (TPMS). 3. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly. 4. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor. 5. Inspect tire and wheel assembly for air loss; determine necessary action. 6. Repair tire following vehicle manufacturer approved procedure. 7. Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate system; verify operation of instrument panel lamps. 8. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system (TPMS) including relearn procedure.
V. Brakes	A. General	1. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. 2. Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS). 3. Install wheel and torque lug nuts.

		4. Identify brake system components and configuration.
	B. Hydraulic System	1. Describe proper brake pedal height, travel, and feel. 2. Check master cylinder for external leaks and proper operation. 3. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports. 4. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification. 7. Test brake fluid for contamination.
	D. Disk Brakes	10. Check brake pad wear indicator; determine necessary action. 11. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendation.
	E. Power Assist Units	2. Identify components of the brake power assist system (vacuum and hydraulic); check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.
	F. Related Systems (i.e. Wheel Bearings, Parking Brakes, Electrical)	1. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings. 2. Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed. 3. Check parking brake operation and parking brake indicator light system operation; determine necessary action. 4. Check operation of brake stop light system. 5. Replace wheel bearing and race. 6. Inspect and replace wheel studs.
VI. Electrical/ Electronic Systems	A. General	1. Research vehicle service information including vehicle service history, service precautions, and technical service bulletins. 2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law). 3. Use wiring diagrams to trace electrical/electronic circuits.

		4. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance. 5. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits. 6. Use a test light to check operation of electrical circuits. 7. Use fused jumper wires to check operation of electrical circuits. 8. Measure key-off battery drain (parasitic draw). 9. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action. 10. Repair and/or replace connectors, terminal ends, and wiring of electrical/electronic systems (including solder repair) 11. Identify electrical/electronic system components and configuration.
	B. Battery Service	1. Perform battery state-of-charge test; determine necessary action. 2. Confirm proper battery capacity for vehicle application; perform battery capacity and load test; determine necessary action. 3. Maintain or restore electronic memory functions. 4. Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs. 5. Perform slow/fast battery charge according to manufacturer's recommendations. 6. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply. 8. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.
	C. Starting System	1. Perform starter current draw test; determine necessary action. 2. Perform starter circuit voltage drop tests; determine necessary action.
	D. Charging System	1. Perform charging system output test; determine necessary action.

		2. Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.
	E. Lighting, Instrument Cluster, Driver Information, and Body Electrical Systems	1. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed. 2. Aim headlights. 4. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation. 5. Remove and reinstall door panel. 7. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators. 8. Verify windshield wiper and washer operation; replace wiper blades.
VIII. Engine Performance	A. General	1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. 7. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.
	C. Fuel, Air Induction, and exhaust Systems	1. Replace fuel filter(s) where applicable. 2. Inspect, service, or replace air filters, filter housings, and intake duct work. 3. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine necessary action. 4. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine necessary action.

Key Vocabulary:			
Acronyms:	OBD	Impeller	Technical Service Bulletin
ABS	Direct Injection	Misfire	Thrust
BCM	Electromagnetism	Propeller	Transaxle
DLC	Fuel injection	Radiator	Voltage Regulator
ECM	Helical	Schematic	Voltmeter
EFI	Hemispherical	Solenoid	Wheel Cylinder

Topics/Content Outline- Units and Themes:

Quarter 1: Safety and Vehicle Inspection

- Careers and Professionalism in the Industry
- Safety in the Lab and Around the Vehicle
- Vehicle Identification and Service Information

Quarter 2: Vehicle Maintenance and Care

- Buying, Owning, and Selling a Vehicle
- Preventative Maintenance
- Welding and Soldering
- Wheels and Tires
- Automotive Engine Design and Technology

Quarter 3: Basic Vehicle Systems

- Lubrication and Cooling Systems
- Battery Service
- Starting and Charging Systems
- Electrical and Lighting Systems

Quarter 4: Basic Vehicle Systems

- Electronic Fuel Injection Systems
- Ignition Systems
- Scan Tool Hook-Up
- Disc and Drum Brakes
- Steering and Suspension Systems

Primary Resource(s):

- **Automotive Technology: A Systems Approach, 6th Edition**
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