

Mandan Public School District

Career & Technical Education

Mandan Public Schools

Automotive Technology Curriculum



2010

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Preface

The Mandan Public Schools Automotive Technology Curriculum Committee revised and updated the Automotive Technology Curriculum. The Automotive Technology Curriculum Committee included the 2007 North Dakota Automotive Technology Content Standards in the curriculum. This updated curriculum will provide Mandan Public School students with the best possible curriculum to assist our students in their career planning and career decision-making.

The Automotive Technology Curriculum is articulated in two ways. First, the curriculum is presented based on the 2007 Automotive Technology Content Standards. The committee identified each benchmark specific student skill and determined the degree to which each benchmark should be addressed in each course. The following IDM coding system was used to convey this:

- I – Introduce
- D – Develop
- M – Master.

The Automotive Technology Curriculum is also articulated according to the 21st Century Skills. The committee identified which Automotive Technology Curriculum benchmarks address specific 21st Century Skills. These 21st Century Skills can be seen in Appendix A.

The Automotive Technology Curriculum IDM matrix lists both Automotive Technology I and Automotive Technology II that are available to students at Mandan High School. Automotive Technology Courses are available to juniors and seniors at Mandan High School. Please read the course descriptions to learn more about the course content.

Thanks to the Automotive Technology Curriculum Committee for their time, effort, and professionalism in working on this curriculum. I also thank the students and parents who serve on the Automotive Technology Advisory Committee at Mandan High School. Mandan Public Schools is fortunate to have such a dedicated hardworking professional who teaches our students automotive technology courses.

Dr. Gaylynn Becker
District Curriculum/Data Coordinator

Mandan Public Schools 2010 Automotive Technology Curriculum Writing Committee Members

<u>Name</u>	<u>Building</u>	<u>Area</u>
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Vision, Mission, Slogan and Philosophy

Mandan Public School District's vision is **“Empowering excellence.”** Its mission is **“Empowering every student to lead a productive life and positively contribute to society.”** Its slogan is **“Mandan Schools: Where the Best Begin.”**

The principal objective of the Board shall be to provide maximum educational opportunities for their students to develop in accordance with their individual needs, abilities, and level of maturity. Teachers shall make efforts to aid students to achieve their maximum development mentally, physically, socially, spiritually, and emotionally so that they may properly adjust to our complex democratic society.

The district shall back up its educational program with supporting services necessary for students' health, safety, and personal well being.

Philosophy of the Automotive Technology Curriculum is:

The philosophy of the Automotive Technology Program is to provide a technical foundation in Automotive Technology with specific job skills for employment in the Automotive Industry and/or pursue additional technical education in a related postsecondary program.

Automotive Technology Curriculum Codes

I – Introduce

D – Develop

M – Master

Anything beyond the mastery level we assume that reinforcement will occur.

**Automotive Technology
Automotive Technology Program Standards**

Standard 1: Auto Shop and Personal Safety	Auto Tech I	Auto Tech II
Topic I: Auto Shop Safety Practices and Safety Equipment Orientation		
1.1.1 Identify general shop safety rules and procedures	I/D	D/M
1.1.2 Utilize safe procedures for handling of tools and equipment	I/D	D/M
1.1.3 Identify and use proper placement of floor jacks and jack stands	I/D	D/M
1.1.4 Identify and use proper procedures for safe lift operation	I/D	D/M
1.1.5 Utilize proper ventilation procedures for working within the lab/shop area	I/D	D/M
1.1.6 Identify marked safety areas	I/D	D
1.1.7 Identify the location and use of fire blankets	I/D	D/M
1.1.8 Identify the location and the types of fire extinguishers; demonstrate knowledge of the procedures for using fire extinguishers	I/D	D/M
1.1.9 Identify the location and use of eye wash stations	I/D	D/M
1.1.10 Identify the location of the posted evacuation routes	I/D	D/M
1.1.11 Comply with the required use of safety glasses, gloves, shoes during lab/shop activities	I/D	D/M
1.1.12 Identify and wear appropriate clothing for lab/shop activities	I/D	D/M
1.1.13 Comply with appropriate hairstyles for lab/shop activities	I/D	D/M
1.1.14 Demonstrate knowledge of safety aspects of supplemental restraint systems (SRS) and antilock brake systems (ABS)	I	I
1.1.15 Locate and demonstrate knowledge of material safety data sheets (MSDS)	I/D	D
Topic 2: Automotive Tool Applications and Proper Usage		
1.2.1 Identify tools and their usage in automotive applications	I/D	D/M
1.2.2 Identify standard and metric designation	I/D	D/M
1.2.3 Demonstrate safe handling and use of appropriate tools	I/D	D/M
1.2.4 Demonstrate proper cleaning, storage, and maintenance of tools and equipment	I/D	D

Topic 3: Service Information Retrieval Systems		
1.3.1 Identify sources of service information	I/D	D
1.3.2 Locate and use paper and electronic manuals	I/D	D/M
1.3.3 Locate and use Technical Service Bulletins (TSBs)	I/D	D
1.3.4 Define the purpose and use of the VIN, engine numbers and date code	I/D	D/M
1.3.5 Locate VIN	I/D	D/M
1.3.6 Apply knowledge of VIN information	I/D	D
Topic 4: Customer Concerns and Proper Vehicle Service Preparation		
1.4.1 Identify information needed and the service requested on a repair order	I/D	D
1.4.2 Identify purpose and demonstrate proper use of fender covers, mats	I/D	D/M
1.4.3 Demonstrate use of the three C's (concern, cause, and correction)	I/D	D
1.4.4 Review vehicle service history	I	D
1.4.5 Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction	I/D	D/M
Topic 5: Quality Control Issues While Preparing the Vehicle for the Customer		
1.5.1 Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.)	I	D
Topic 6: Vehicle Maintenance and Inspection Techniques		
1.6.1 Check and adjust engine oil level	I/D	D/M
1.6.2 Check and adjust engine coolant level	I/D	D/M
1.6.3 Check and adjust power steering fluid level	I/D	D/M
1.6.4 Check and adjust brake fluid level	I/D	D/M
1.6.5 Check and adjust windshield washer fluid level	I/D	D/M
1.6.6 Check and replace wiper blades	I	D
1.6.7 Check and adjust differential/transfer case fluid level	I/D	D/M
1.6.8 Check and adjust transmission fluid level	I/D	D/M
1.6.9 Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment	I/D	D/M
1.6.10 Inspect and replace air filter	I/D	D/M
1.6.11 Determine fluid type requirements and identify fluid	I/D	D

Standard 2: Suspension and Steering	Auto Tech I	Auto Tech II
Topic 1: Steering and Suspension Systems		
2.1.1 Identify and interpret suspension and steering concern; determine necessary action		
2.1.2 Determine proper power steering fluid types; inspect fluid levels and condition		
2.1.3 Flush, fill, and bleed power steering system		
2.1.4 Diagnose power steering fluid leakage; determine necessary action	I/D	D/M
2.1.5 Lubricate suspension and steering systems	I/D	D/M
2.1.6 Inspect, remove, and replace shock absorbers		
2.1.7 Remove, inspect, and install stabilizer bar bushings, brackets, and links		
2.1.8 Remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount		
2.1.9 Perform pre-alignment inspection; determine necessary action		
2.1.10 Measure vehicle riding height; determine necessary action		
2.1.11 Diagnose tire wear patterns; determine necessary action		
2.1.12 Inspect tires; check and adjust air pressure	I/D	D/M
2.1.13 Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action		
2.1.14 Rotate tires according to manufacturer's recommendations		
2.1.15 Balance wheel and tire assembly (static and dynamic)		
2.1.16 Dismount, inspect, and remount tire on wheel		
2.1.17 Repair tire using internal patch		
2.1.18 Reinstall wheel; torque lug nuts	I/D	D/M

Standard 3: Brakes	Auto Tech I	Auto Tech II
Topic 1: Brake Components, Inspection, and Repair of Brake Systems		
3.1.1 Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear, tighten loose fittings and supports; determine necessary action	I/D/M	
3.1.2 Select, handle, store, and fill brake fluids to proper level	I/D/M	
3.1.3 Bleed (manual, pressure, vacuum, or surge) brake system	I/D/M	
3.1.4 Flush hydraulic system	I/D/M	
3.1.5 Remove, clean (using proper safety procedures), inspect and measure brake drums; determine necessary action	I/D/M	
3.1.6 Refinish brake drum	I/D/M	
3.1.7 Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble	I/D/M	
3.1.8 Remove, inspect, and install wheel cylinders	I/D/M	
3.1.9 Pre-adjust brake shoes and parking brake before installing brake drums or dumb/hub assemblies and wheel bearings	I/D/M	
3.1.10 Install wheel, torque lug nuts, and make final checks and adjustments	I/D/M	
3.1.11 Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing; determine necessary action	I/D/M	
3.1.12 Clean and inspect caliper mounting and slides for wear and damage; determine necessary action	I/D	
3.1.13 Remove, clean, and inspect pads and retaining hardware; determine necessary action	I/D/M	
3.1.14 Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks	I/D/M	
3.1.15 Clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer's recommendations in determining need to machine or replace	I/D/M	
3.1.16 Remove and reinstall rotor	I/D/M	
3.1.17 Refinish rotor on vehicle	I/D/M	
3.1.18 Refinish rotor off vehicle	I/D/M	
3.1.19 Install wheel, torque lug nuts, and make final checks and adjustments	I/D/M	

3.1.20 Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster	I/D/M	
3.1.21 Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action	I/D/M	
3.1.22 Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action	I/D/M	
3.1.23 Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, or replace as needed	I/D	
3.1.24 Check parking brake operation; determine necessary action	I/D/M	
3.1.25 Check operation of parking brake operation indicator light system	I/D/M	
3.1.26 Check operation of brake stop light system; determine necessary action	I/D/M	
3.1.27 Replace wheel bearing and race	I/D/M	
3.1.28 Identify and inspect antilock brake system (ABS) components; determine necessary action	I	
3.1.29 Identify traction control/vehicle stability control system components		
Standard 4: Electrical and Electronic Systems	Auto Tech I	Auto Tech II
Topic 1: Electrical and Electronic Systems Measurement and Testing		
4.1.1 Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits using principles of electricity (Ohm's Law)	I/D/M	
4.1.2 Use wiring diagrams during diagnosis of electrical circuit problems	I/D/M	M
4.1.3 Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems	I/D/M	M
4.1.4 Check electrical circuits with a test light; determine necessary action	I/D/M	M
4.1.5 Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine	I/D/M	M

necessary action		
4.1.6 Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action	I/D/M	M
4.1.7 Check continuity and measure resistance in electrical/electronic circuits and components using an ohmmeter; determine necessary action	I/D/M	M
4.1.8 Check electrical circuits using fused jumper wires; determine necessary action		
4.1.9 Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action	I/D/M	M
4.1.10 Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action	I	
4.1.11 Inspect and test fusible links, circuit breakers, and fuses; determine necessary action	I/D/M	M
4.1.12 Inspect and test switches, connectors, relays, solid state devices, and wires of electrical/electronic circuits; perform necessary action	I/D/M	M
4.1.13 Repair connectors and terminal ends	I/D/M	M
4.1.14 Repair wiring harness (including CAN/BUS systems)	I/D/M	M
4.1.15 Perform solder repair of electrical wiring	I/D/M	M
4.1.16 Perform battery state-of-charge test; determine necessary action	I/D/M	M
4.1.17 Perform battery capacity test (or conductance test); confirm proper battery capacity for vehicle application determine necessary action	I/D/M	M
4.1.18 Maintain or restore electronic memory functions		
4.1.19 Inspect, clean, fill, and replace battery	I/D/M	
4.1.20 Perform slow/fast battery charge	I/D/M	M
4.1.21 Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed	I/D/M	M
4.1.22 Start a vehicle using jumper cables and a battery or auxiliary power supply	I/D/M	M
4.1.23 Perform starter current draw tests; determine starter current draw tests; determine necessary action	I/D/M	M
4.1.24 Perform starter circuit voltage drop tests; determine necessary action	I/D/M	
4.1.25 Inspect and test starter relays and solenoids; determine necessary action	I/D/M	M
4.1.26 Differentiate between electrical and engine mechanical	I/D/M	

problems that cause a slow-crank or no-crank condition		
4.1.27 Perform charging system output test; determine necessary action	I/D/M	M
4.1.28 Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action	I/D	
4.1.29 Inspect, replace, and aim headlights and bulbs	I/D/M	
Standard 5: Engine Performance	Auto Tech I	Auto Tech II
Topic 1: Engine Performance and Diagnostic Tasks		
5.1.1 Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).	I/D	D/M
5.1.2 Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action	I/D	D/M
5.1.3 Perform cylinder power balance test; determine necessary action		I
5.1.4 Perform cylinder cranking compression test; determine necessary action		I/D/M
5.1.5 Perform cylinder leakage test; determine necessary action		I/D/M
5.1.6 Verify engine operating temperature; determine necessary action		I/D/M
5.1.7 Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; determine necessary action		
5.1.8 Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action		I/D/M
5.1.9 Retrieve and record stored OBD I diagnostic trouble codes; clear codes	I	D/M
5.1.10 Retrieve and record stored OBD II diagnostic trouble codes; clear codes when applicable	I	D/M
5.1.11 Obtain and interpret scan tool data	I	I/D/M
5.1.12 Replace fuel filters		I
5.1.13 Remove and replace thermostat and gasket	I	D/M
5.5.14 Perform common fastener and thread repair to include, remove broken bold, restore internal and external threads, and repair internal threads with thread insert	I/D	D/M

Standard 6: Automatic Transmission Maintenance Procedures	Auto Tech I	Auto Tech II
Topic 1: Automatic Transmission Maintenance Procedures		
6.1.1 Service transmission; perform visual inspection of transmission; replace fluids and filters	I	I/D
Standard 7: Engine Repair	Auto Tech I	Auto Tech II
Topic 1: Engine Maintenance Procedures		
7.1.1 Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action	I/D	D/M
7.1.2 Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required		I/D/M
7.1.3 Perform oil and filter change	I/D	D/M
7.1.4 Remove and replace radiator		I/D/M
7.1.5 Inspect powertrain mounts; determine necessary action		I/D/M
Standard 8: Heating and Air Conditioning	Auto Tech I	Auto Tech II
Topic 1: Air Conditioning System Components and Temperature Diagnosis		
8.1.1 Identify and visually inspect A/C system components		
8.1.2 Locate refrigerant label and identify specified refrigerant type (e.g., R-12, R-134a)		
8.1.3 Conduct preliminary performance test of A/C system (i.e., verify compressor engagement, measure outlet duct temperature, sense temperature change across A/C components); determine necessary action		

Standard 9: Manual Drive Train and Axles	Auto Tech I	Auto Tech II
Topic 1: Manual Driveline System Maintenance		
9.1.1 Diagnose fluid loss, level, and condition concerns; determine necessary action	I/D	D/M
9.1.2 Drain and fill transmission/transaxle and final drive unit	I/D	D/M
9.1.3 Inspect clutch pedal linkage, cables, automatic adjuster mechanism, brackets, bushings, pivots, and springs; determine necessary action		I/D/M
9.1.4 Inspect hydraulic clutch slave and master cylinders, lines, and hoses; determine necessary action		I/D/M
9.1.5 Bleed clutch hydraulic system		I/D
9.1.6 Diagnose fluid leakage concerns	I/D	D
9.1.7 Inspect and replace drive axle shaft wheel studs	I/D/M	
9.1.8 Inspect constant-velocity (CV) joint boots	I/D	D/M
9.1.9 Remove and replace rear wheel drive shaft		I/D/M

Course Descriptions and Outlines

Automotive Technology I

Course Description

Grade: 11-12

Term: 2 Semesters- 2 Hours per day

Credit: Two

Prerequisite: none

Description: This is the study of an automobile. This will be a hands-on experience class involving activities that relate directly to maintenance, repair and service. The program of instruction may include: safety in the shop, care and use of tools, interpretation of parts books, parts handling, engine construction, ignition systems, fuel systems, charging systems, starting systems, electronic systems, chassis wiring and diagrams, brakes, lubrications and minor tune-up. Students may take Auto Mechanics I and not Auto Mechanics II. The students may be involved in the Ford AAA Student Auto Skills Contest, as well as the Skills USA Club.

Course Outline

Orientation	Introduce Develop Master
A. Occupational outlook	I
B. Places that employ auto mechanics	I
C. Student requirements for the auto mechanics program	I/D
D. Steps involved in automotive shop work	I/D
E. Skills USA	I
F. Ways Skills USA state and national dues are used	I
G. Mandan automotive program rules	I/D
H. MSDA	I/D
I. Personal information sheet	I/D/M
J. Follow instructions sheet	I/D/M
K. Job application form	I/D/M

Safety	
I. Safety	
A. Terms related to the unit	I/D/M
B. Colors and application of the safety color code	I/D/M
C. Personal safety rules	I/D/M
D. General shop safety rules	I/D/M
E. Safety rules involving hand tools	I/D/M
F. Safety rules involving the engine	I/D/M
G. Battery safety	I/D/M
H. Safety rules involving flammable liquids	I/D/M
I. Equipment safety rules	I/D/M
J. Components of the fire triangle	I/D/M
K. Classes of fire	I/D/M
L. Types of fire extinguishers	I/D/M
II. Machine Safety Rules	
A. Parts washer	I/D/M
B. Engine hoist	I/D/M
C. Grinder	I/D/M
D. Hydraulic press	I/D/M
E. Drill press	I/D/M
F. Hoist	I/D/M
G. Floor jack	I/D/M
H. Pressure washer	I/D/M
III. Automotive lift	
A. Safety tips	I/D/M
B. Safety pledge form	I/D/M
IV. Safety Review	
A. Individual Student Shop Safety Inspection Form	I/D/M
Hand Tools	
A. Purpose of hand tools & storage	I/D/M
B. Types of screwdrivers	I/D/M
C. Types of pliers	I/D/M
D. Types of wrenches	I/D/M
E. Components of a socket set	I/D/M

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F. Types of sockets	I/D/M
G. Special purpose sockets	I/D/M
H. Types of hammers used in the auto shop	I/D/M
I. Types of punches	I/D/M
J. Types of chisels	I/D/M
K. Types of files	I/D/M
L. Types of file teeth	I/D/M
M. Types of parts cleaning tools	I/D/M
N. General shop tools	I/D/M
O. Battery service tools	I/D/M
P. Starter service tools	I/D/M
Q. Charging system service tools	I/D/M
R. Ignition service tools	I/D/M
S. Fuel system service tools	I/D/M
T. Exhaust system service tools	I/D/M
U. Cooling system service tools	I/D/M
V. Lubrication service tools	I/D/M
W. Brake service tools	I/D/M
X. Front-end service tools	I/D/M
Y. Engine repair tools	I/D/M
Z. Drive line service tools	I/D/M
AA. General Torque Specification Chart	I
Rules and Measures	
I. Rules	
A. Terms related to the unit	I
B. Basic units of measurement	I/D
C. Fractional units found on rules	I/D
D. Decimal units found on rules	I/D
E. Metric units found on rules	I/D
F. Rules used in shop work	I
G. Uses of the rule with accessories	I
H. Procedure for using rules	I/D
I. Steps for reading the rules	I/D
II. Outside micrometer	
A. Types of measurements found on the outside micrometer	I/D/M
B. Major parts of the outside micrometer	I
C. Steps in selecting the proper size outside micrometer	I/D/M

D. General rules for use and care of micrometers	I/D
E. Definition of “feel” when using a micrometer	I/D
F. Methods of checking accuracy of outside micrometers	I/D/M
G. Reading the plane micrometer	I/D/M
H. Reading the vernier micrometer	I/D/M
Service Manuals	
A. Car information section	I/D/M
B. General service information section	I/D/M
C. Carline unit index	I/D/M
D. Specification sheets	I/D/M
E. Repair information section	I/D/M
F. Labor and parts guide	I/D/M
G. Repair order	I/D/M
Electrical Unit	
I. Basic electrical theory	
A. Terms related to basic electricity	I
B. Parts of the atom and their values	I
C. Electricity according to the electron theory	I
D. Basic factors of electrical flow in a circuit	I
E. Relationship of voltage, amperage, and ohms to current flow	I/D
F. Ohms Law	I/D/M
G. Calculating problems using Ohms Law	I/D/M
H. Factors effecting resistance in a conductor	I/D
I. Basic electrical symbols	I/D/M
J. Components of a basic electrical circuit	I/D/M
K. Types of electrical circuits	I/D/M
L. Instruments for testing electrical circuits	I/D/M
M. Methods of connecting test instruments	I/D/M
N. Basic electrical circuit failures	I/D
O. Characteristics of magnetism	I/D
P. Characteristics of electromagnetism	I/D
Q. Electromagnetic induction	I/D
R. Factors determining magnitude of induce voltage	I/D

II. Battery service	
A. Terms related to the battery	I
B. Functions of a battery	I/D
C. Purposes of the battery parts	I/D
D. Converting chemical energy into electrical energy	I/D
E. Factors affecting battery voltage and capacity	I/D
F. Battery capacity in amperes	I/D
G. Types of battery rating	I/D
H. Safety rules	I/D/M
I. Features of a service-free battery	I
J. Jump starting a vehicle	I/D
III. Charging system	
A. Purpose of the charging system	I/D
B. Terms related to the charging system	I
C. Charging system components	I
D. Parts of the generator	I
E. Parts of the alternator	I/D/M
F. Differences between an alternator and generator	I/D
G. Advantages of a alternator over a generator	I/D
H. Reason an alternator produces more current at low speed than a generator	I/D
I. Stator construction	I/D
J. Types of stator windings	I/D
K. Current and voltage regulation in an alternator	I/D
L. Types of voltage regulators for alternators	I/D
M. Troubleshooting the charging system	I/D/M
IV. Starting system	
A. Terms related to the starting system	I/D
B. Purpose of the starting system	I/D
C. Operating principle of the starter	I
D. Magnetic principles of the starter	I
E. Path of current flow in a series wound starter	I
F. Components of the starting system	I/D
G. Types of starter switches	I/D
H. Parts of the starter	I/D/M
I. Major parts of the gear reduction starter	I/D/M
J. Types of starter drives	I/D
K. Components of a starter control circuit	I/D
L. Starting system control circuit components and their functions	I/D
M. Troubleshooting the starting system	I/D/M

V. Ignition system	
A. Terms related to the ignition system	I/D
B. Purpose of the ignition system	I/D
C. Components of the ignition system	I/D
D. Function of the ignition system components	I/D
E. Distributor components	I/D/M
F. Components of the ignition system circuits	I/D
G. Operation of the ignition system	I/D
H. Parts of the spark plug	I
I. Spark plug heat ranges	I
J. Spark plug conditions and their causes	I/D/M
K. Types of secondary ignition cables	I/D
L. Transistorized and capacitive discharge ignition system	I
M. Relationship of the electronic ignition system to the conventional ignition system	I/D
N. Advantages of the electronic ignition system	I/D
O. Major components of the electronic ignition system	I/D/M
P. Function of the components of the electronic ignition system	I/D
Q. Operation of the electronic ignitions system	I/D
VI. Chassis wiring	
A. Terms related to chassis wiring	I
B. Electrical symbols	I/D
C. Types of electrical terminals and connectors	I/D
D. Types of bulbs used in automobiles	I
E. Parts of the sealed beam	I
F. Differences between hot and ground circuits	I/D
G. Facts about voltage drop	I/D/M
H. Facts about current draw	I/D/M
I. Single and two-wire circuits	I/D
J. Instruments used in testing automobile electrical circuits	I/D/M
K. Steps in diagnosis of an electrical problem	I/D/M
L. Characteristics of a wiring diagram	I/D/M
M. Parts of a typical circuit identification code	I/D/M
Brake Unit	
I. Wheel bearings	
A. Terms related to unit	I/D
B. Types of front wheel bearings	I/D/M
C. Parts of a tapered roller front wheel bearing assembly	I/D/M

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D. Characteristics of quality wheel bearing grease	I
E. Precautions to observe while packing wheel bearings	I/D/M
II. Brake systems	
A. Purpose of the brake system	I/D
B. Terms related to unit	I/D
C. Components of the standard brake system	I/D/M
D. Components of the tandem or dual brake system	I/D/M
E. Parts of a standard master cylinder	I/D/M
F. Parts of a tandem master cylinder	I/D/M
G. Parts of a wheel cylinder	I/D/M
H. Parts of a standard brake assembly	I/D/M
I. Types of self-adjusting brake systems	I/D
J. Brake operation	I/D/M
III. Power disc brakes	
A. Terms related to unit	I/D
B. Major components of the disc brake system	I/D
C. Disc brake components and their functions	I/D
D. Types of disc brake calipers	I
E. Parts of a floating caliper disc brake	I/D/M
F. Characteristics of disc brakes	I
G. Reasons disc brakes may require power booster units	I/D
H. Sources of energy used for power boosters	I
I. Types of vacuum operated power boosters	I/D
J. Major parts of a vacuum operated power booster	I
K. Major parts of a hydro-boost power booster	I
L. Operation of the vacuum suspended power booster	I/D/M
M. Operation of the atmospheric suspended power booster	I/D/M
N. Operation of the hydro-boost power booster	I/D/M
O. Requirements of super heavy-duty brake fluid	I
P. Conditions that are considered normal and are not indications that the master cylinder needs service	I/D/M
Q. Parts of a parking brake system on four wheel disc brakes	I
IV. Anti-lock brake system	
A. Safety precautions	I/D/M
B. Lug nut torque specifications	I/D/M
C. Description	I
D. Operation	I
E. Diagnosis and testing	I/D
F. Note on intermittents	I

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G. Depressurizing the system	I/D
H. Component removal and installation	I
J. Wheel sensor air gap	I
K. Bleeding brake system	I/D/M
L. Reading wiring diagrams	I/D
M. Pin-out checks	I

Automotive Technology II

Course Description

Grade: 12

Term: 2 Semesters- 2 Hours per day

Credit: Two

Prerequisite: Automotive Technology I

Description: This is a continuation of the Auto Mechanics I course with more advanced training and more skill required in the use of tools and equipment. This course is designed to give the students the opportunity to learn practical application along with the related material in the following areas: engine rebuilding, transmissions, clutch, drive train, differentials, major tune-up, and electronic emission control systems. The students may be involved in the Ford/AAA Student Auto Skills Contest, as well as the Skills USA Club.

Course Outline

Engine Repair	Introduce Develop Master
I. Basic Engine Principles	
A. Terms related to the unit	I
B. Characteristics of energy	I
C. Types of energy	I
D. Forms of available energy	I
E. Types of motion	I
F. Simple machines	I
G. Uses of simple machines	I
H. Calculating work	I/D
I. Calculating horsepower	I/D
J. Formula for torque	I/D
K. Characteristic of heat engines	I
L. Types of heat engines	I
M. Parts of basic internal combustion engine	I/D

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N. Process for converting chemical energy into rotary motion	I
O. Operation of four-stroke cycle engine	I/D/M
P. Valve timing and overlap	I/D
Q. Operation of two-stroke cycle engine	I/D
R. Formula for cubic inch displacement	I/D
S. Results of increasing compression ratio	I/D
T. Components of an automobile engine	I/D
U. Gasoline and diesel engines	I
V. Purpose of a heavy flywheel	I
II. Engine Condition Evaluation	
A. Terms related to unit	I
B. Conditions causing low oil pressure	I/D
C. Conditions that cause oil consumption	I/D
D. Items to inspect for engine condition evaluation	I/D/M
E. Items to check prior to testing for internal engine noise	I/D/M
F. Internal engine noise diagnosis	I/D/M
III. Engine Removal	
A. Terms related to unit	I
B. Safety precautions to observe while removing an engine	I/D/M
IV. Engine Disassembly	
A. Terms related to unit	I/D
B. Safety precautions to observe during engine disassembly	I/D/M
C. Factors to consider when preparing to disassemble an engine	I/D
D. Items to inspect during engine assembly	I/D/M
V. Valve Train and Cylinder Head Reconditioning	
A. Terms related to unit	I/D
B. Purpose of the valve train	I
C. Parts of the valve train	I/D
D. Function of valve train parts	I/D
E. Camshaft locations	I
F. Methods of driving the camshaft	I/D
G. Parts of the camshaft	I/D
H. Parts of the cam lobe	I/D/M
I. Types of valve lifters	I/D/M
J. Parts of a hydraulic valve lifter	I/D/M
K. Operation of a hydraulic valve lifter	I/D
L. Parts of the valve	I/D/M
M. Parts of a valve assembly	I/D/M
N. Types of valve springs and dampering devices	I/D/M

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O. Types of valve stem seals	I/D/M
P. Types of valve spring keepers	I/D/M
Q. Purpose of valve spring spacer	I/D
R. Types of valve rotators	I/D
S. Purpose of valve rotator	I/D
T. Reasons a valve must seat properly	I/D/M
U. Causes of valve burning	I/D/M
V. Tools of valve reconditioning	I/D/M
VI. Engine Crankshaft, Bearings and Oil Pump	
A. Terms related to unit	I
B. Purpose of the crankshaft	I/D
C. Parts of the crankshaft	I/D
D. Methods used to manufacture crankshafts	I
E. Types of bearing used on the cam and crankshaft	I/D
F. Construction of an insert bearing	I
G. Bearing spread and crush	I/D
H. Bearing requirements	I/D
I. Causes of bearing failure	I/D/M
J. Action of lubricating oil in an insert bearing	I/D
K. Purpose of torsional vibration damper and flywheel	I
L. Types of rear main bearing oil seals	I/D
M. Types of oil pumps	I/D
N. Parts of an oil pump	I/D
O. Conditions that could lower oil pressure	I/D/M
VII. Cylinder and Piston Reconditioning	
A. Terms related to unit	I
B. Cylinder wear patterns	I/D
C. Methods of reconditioning cylinders	I/D/M
D. Types of cylinder sleeves	I
E. Reasons cylinders wear tapered	I/D
F. Parts of the cylinder block	I/D
G. Types of cylinder block core hole plugs	I/D
H. Parts of a piston and connecting rod assembly	I/D
I. Types of compression rings	I/D
J. Methods of installing compression rings	I/D/M
K. Types of oil rings	I/D
L. Methods of installing oil rings	I/D/M
M. Methods of heat and expansion control in the piston	I
N. Piston conditions and related causes	I/D/M

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O. Lubrication of cylinder walls and piston pins	I/D
P. Tools and equipment used in reconditioning cylinders and pistons	I/D/M
Q. Types of piston pin locks	I/D
VIII. Engine Reassembly	
A. Terms related to unit	I
B. Tools used in engine reassembly	I/D/M
C. Reasons for torquing bolts to specifications in an engine	I/D/M
IX. Engine Installation	
A. Terms related to unit	I
B. Safety precautions to observe during engine installation	I/D/M
C. Factors to consider when installing an engine	I/D/M
D. Items to check or adjust before starting a new or rebuilt engine	I/D/M
E. Break-in procedure	I/D/M
X. Cooling System	
A. Purpose of the cooling system	I/D
B. Terms related to unit	I
C. Types of thermostats	I/D
D. Thermostat operation	I/D/M
E. Job performed by the cooling system	I/D
F. Downflow and crossflow radiators	I
G. Methods of cooling the internal combustion engine	I/D
H. Types of radiator hoses	I/D
I. Pressure cap operation at various temperatures	I/D/M
J. Variable-speed fan drive operations	I/D/M
K. Reasons for using permanent antifreeze solution	I/D
L. Operation of the coolant recovery system	I/D
M. Belt tension	I/D/M
N. Belt inspection	I/D/M
XI. Engine Lubrication System	
A. Terms related to unit	I
B. Purpose of the engine lubrication system	I
C. Components of the engine lubrication system	I/D
D. Purposes of the components of the engine lubrication system	I/D
E. Types of oil filters	I/D
F. Engine oil classifications	I
G. Oil viscosity classifications	I
H. Oil service designation letters and their descriptions	I
I. Points to consider when selecting engine oil	I/D
J. Additives found in engine oil	I

XII. Exhaust System	
A. Purpose of the exhaust system	I
B. Terms related to unit	I
C. Types of mufflers	I
D. Operation of the manifold heat control valve	I
E. Construction and operation of catalytic converter	I
F. Tools for exhaust system service	I
G. Types of exhaust systems	I
H. Prevention of carbon monoxide poisoning	I/D
I. Causes of corrosion of exhaust system	I
J. Basic components of the exhaust gas recirculating system	I
K. Purpose of exhaust gas recirculating system	I
XIII. Fuel System	
A. Purpose of the fuel system	I
B. Terms related to unit	I
C. Components of the fuel system and their purposes	I
D. Fuel pump operation	I
E. Types of fuel filters	I
F. Types of air cleaners	I
G. Parts of the carburetor	I
H. Carburetor systems and their uses	I
I. Gasoline additives and their purposes	I
J. Fuel injection	I
K. Variations of fuel injection systems	I
Manual Drive Train	
I. Clutch Assembly	
A. Terms related to the unit	I
B. Components of the clutch assembly	I/D
C. Parts of a clutch disc	I
D. Types of pressure plates	I/D
E. Clutch operation	I/D
F. Methods used to actuate clutch release	I
G. Mechanisms that allow smooth clutch engagement	I
H. Conditions to look for during clutch inspection	I/D/M
I. Symptoms that may occur when a clutch housing bore has excessive run-out	I
J. Clutch malfunctions and probable causes	I/D/M
K. Problems not requiring clutch removal	I/D/M

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L. Clutch problems requiring clutch removal	I/D/M
II. Standard Transmission	
A. Purpose of the transmission	I
B. Terms related to the unit	I
C. Parts of the transmission	I/D/M
D. Parts of a synchronizer	I/D/M
E. Types of gear teeth	I/D/M
F. Three-speed synchromesh transmission operation	I/D/M
G. Gear operation of a three-speed transmission	I/D/M
H. Basic types of overdrives	I
I. Major parts of the electrically operated overdrive	I
J. Operation of the electrically operated overdrive	I
K. Procedure for performance testing shift linkage adjustment	I/D/M
L. Procedure for performance testing the manual transmission	I/D/M
III. Drive Lines	
A. Terms related to the unit	I
B. Types of drive lines	I
C. Components of a propeller shaft	I
D. Types of U-joints	I
E. Parts of a cross and roller or cardan U-joint	I/D/M
F. Parts of a ball and trunnion U-joint	I
H. Parts of a constant velocity U-joint	I/D/M
I. Acceleration-deceleration of propeller shaft equipped with a cross and roller U-joint	I
J. Major components of a four wheel drive	I
K. Tools used in drive line repair	I
L. Methods of controlling drive line vibration	I
IV. Rear Axle	
A. Purpose of the rear axle assembly	I
B. Terms related to the unit	I
C. Parts of a gear tooth	I/D/M
D. Parts of a conventional differential	I/D/M
E. Parts of the planetary differential	I/D/M
F. Types of differential carrier housings	I/D
G. Ring gear and drive pinion tooth contact pattern	I/D/M
H. Gear tooth contact patterns	I/D/M
I. Types of rear axle shafts	I/D
J. Types of rear axle bearings	I/D
V. Automatic Transmission Service	
A. Terms related to the unit	I

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B. Repairs which can be performed with the transmission in the vehicle	I
C. Items to include in a automatic transmission tune-up	I
D. Tests that are performed while transmission is in the vehicle	I/D
E. Types of automatic transmission fluids and their applications	I/D/M
F. Procedure for properly checking transmission fluid level	I/D/M
G. Fluid conditions and possible transmission problems	I/D
H. Types of transmission filters	I
VI. Manual Transaxle Operation	
A. Terms related to the unit	I
B. Transaxle components and how they function	I/D/M
C. Transaxle operation	I/D
VII. Manual Transaxle Diagnosis	
A. The operation and design	I/D/M
B. Half shaft diagnosis	I/D/M
VIII. Transaxle Removal and Disassembly	
A. Safety in transaxle removal	I/D/M
B. Procedure for removing the transaxle	I/D
C. Transaxle disassembly	I/D/M
IX. Transaxle Cleaning, Inspection and Assembly	
A. Procedure for cleaning and inspecting transaxle components	I/D/M
B. Clutch inspection	I/D/M
C. Procedure for reassembling and adjusting the transaxle	I/D/M
D. Half shaft repair procedures	I/D/M
X. Transaxle Installation and Performance Testing	
A. Transaxle installation	I/D
B. Procedures for performance testing the transaxle	I/D
XI. Four-Wheel-Drive Components and Operation	
A. Terms related to the unit	I
B. Four-wheel-drive components and functions	I
C. Driveline operation	I
XII. Four-Wheel-Drive Diagnosis and Repair	
A. Safety in four-wheel-drive diagnosis and repair	I/D/M
B. Procedures for diagnosing a four-wheel-drive vehicle	I
C. Repair procedures for locking hubs	I
D. Procedure for removing the front differential assembly	I
E. Repair procedures for front spindals	I
XIII. Transfer Case Components and How They Function	
A. Transfer case components and their functions	I
B. Transfer case operation	I

XIV. Transfer Case Diagnosis and Removal	
A. Transfer case diagnosis	I
B. Safety in transfer case removal	I/D/M
C. Procedures for removing the transfer case	I
XV. Transfer Case Disassembly, Cleaning, Adjustment and Reassembly	
A. Procedure for disassembly of the transfer case	I
B. Procedure for cleaning and inspecting the transfer case	I
C. Transfer case end-play and torque measurements	I
D. Procedure for reassembly of the transfer case	I
XVI. Transfer Case Installation and Performance Testing	
A. Transfer case installation	I
B. Procedure for performance testing and transfer case	I

Appendix A

21st Century Skills – 12th Grade

The Partnership for 21st Century Skills organization in cooperation with the National Council of Teachers of English developed a 21st Century Skills Map. The 21st Century Skills Map has so far been developed at grades 4, 8, and 12.

We did an alignment between the 21st Century Skills Map and Mandan Public Schools' Automotive Technology Curriculum. Not all of the 21st Century Skills are addressed by Mandan Public Schools' Automotive Technology Curriculum. However, some of the skills may also be addressed by other curriculums in Mandan Public Schools. This match is a guide to assist us in the identification of which 21st Century Skills align to specific benchmarks in each grade. If someone else did the match, we would expect slightly different results.

We numbered the 12 broad 21st Century Skills 1-12. In front of each 21st Century Skill is a digit which indicates the grade level at which the 21st Century Skill was developed. Each of these 12 skills has 1 or more sub-skills. We numbered the sub-skills with a decimal point followed by another digit in numerical sequence.

The numbers in parenthesis below the 21st Century sub-skills refer to Mandan Public Schools' Automotive Technology Curriculum. The first digit in parenthesis refers to the standard. The second digit in the parenthesis refers to the topic. The third digit in parenthesis refers to the benchmark.

It is important that these 21st Century Skills be addressed by the various components of the school curriculum. As new state standards and benchmarks are developed, we hope that they will address the 21st Century Skills.

12.1 Creativity and Innovation

12.1.1 Develop and communicate new ideas to others
(1.4.1; 1.4.2; 1.4.3)

12.1.2 Demonstrate originality and inventiveness in work

12.1.3 Act on creative ideas to make a tangible and useful contribution to the domain in which the innovation occurs

12.2 Critical Thinking & Problem Solving

12.2.1 Frame, analyze and synthesize information in order to solve problems and answer questions
(3.1.22; 4.1.1; 4.1.2; 4.1.9; 4.1.10; 9.1.1; 9.1.6)

12.2.2 Identify and ask significant questions that clarify various points of view

12.2.3 Exercise sound reasoning in understanding
(3.1.22; 4.1.1; 4.1.2; 4.1.9; 4.1.10; 9.1.1; 9.1.6)

12.3 Communication

12.3.1 Articulate thoughts clearly and effectively through writing, speaking, and multimedia
(1.3.4; 1.4.1; 1.4.2; 1.4.3; 1.4.5)

12.3.2 Articulate thoughts clearly and effectively through writing
(1.4.5)

12.4 Collaboration

12.4.1 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal

12.4.2 Assume shared responsibility for collaborative work

12.4.3 Demonstrate the ability to work effectively with diverse teams

12.5 Information Literacy

12.5.1 Possess and share a fundamental understanding of the ethical/legal issues surrounding the access and use of information

12.5.2 Use information accurately and creatively for the issue or problem at hand
(1.3.2; 1.3.3; 1.3.6; 1.4.1; 1.4.5; 4.1.1; 4.1.2; 4.1.3)

12.6 Media Literacy

12.6.1 Understand how media messages are constructed, for what purposes and using which tools, characteristics and conventions

12.7 ICT Literacy

12.7.1 Use technology as a tool to research, organize, evaluate and communicate information, and possess a fundamental understanding of the ethical/legal issues surrounding the access and use of information
(1.4.4; 1.4.5)

12.7.2 Use technology as a tool to communicate information
(1.4.5)

12.7.3 Use digital technology, communication tools and/or networks appropriately to integrate, evaluate, and create information
(4.1.1; 4.1.2; 4.1.3; 4.1.4; 4.1.5; 4.1.8; 4.1.9; 4.1.10; 4.1.11)

12.8 Flexibility & Adaptability

12.8.1 Work effectively in a climate of ambiguity and changing priorities

12.9 Initiative & Self-Direction

12.9.1 Go beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise

12.9.1 Demonstrate commitment to learning as a lifelong process

12.10 Social & Cross-Cultural Skills

12.10.1 Bridge cultural differences and use differing perspectives to increase innovation and the quality of work

12.10.2_Leverage the collective intelligence of groups when appropriate

12.11 Productivity & Accountability

12.11.1 Demonstrate diligence and a positive work ethic (e.g., being punctual and reliable).

12.12 Leadership & Responsibility

12.12.1 Act responsibly with the interests of the larger community in mind