

2009-2010 Course Catalog

The University Of Montana

Department of Industrial Technology

Alan P. Fugleberg, Associate Dean & Chair

The mission of the Department of Industrial Technology is to provide the regional workforce with credentialed, skilled, and competent entry-level technicians, and to be responsive to emerging workforce needs. The Department encourages the development of teamwork and interpersonal communication skills required in the workplace. It also stresses the importance of a strong work ethic and the value of continuing education and lifelong learning. The instruction for the Certificate of Applied Science and A.A.S. degree programs are primarily delivered at the West Campus at 3639 South Avenue West. Some instruction is delivered at the East Campus or Mountain Campus.

Special Certificate and Degree Requirements

The general education requirements are included in the following courses of study. Refer to the Academic Policies and Procedures section of this catalog for the specific requirements.

Course Fees, Tools, and Supplies

Courses in all programs in the Department of Industrial Technology include additional course fees and require special tools and supplies for which students must pay. To obtain a complete listing of these additional items and costs, contact the program directors.

Building Maintenance-Certificate of Applied Science

The mission of the Building Maintenance Program is to provide the regional workforce with credentialed, skilled and competent building maintenance professionals, and to be responsive to emerging workforce needs.

Students in the Building Maintenance program are trained as building maintenance professionals who maintain commercial buildings. Subject matter in the program includes plumbing, electricity, carpentry, and heating/air conditioning. Students learn physical and electrical theories that enable them to understand building systems. In addition, they study building cleaning, landscape maintenance, pool care, computers, and boiler operation. Water treatment is discussed in both the pool and boiler courses.

The program introduces current environmental and energy problems that can be reduced through efficient building operation. It also encourages resource development, teamwork and interpersonal skills required on the job.

Students are awarded a Certificate of Applied Science upon successfully completing the program. Contact John Walker, Program Director, at 406-243-7645 or john.walker@umontana.edu for more information.

Autumn and Spring Entry:

Course	A	S
BME 122T Electricity -		5
BME 123T Carpentry 6		-
BME 127T Low Pressure Boilers -		3
BME 128T Maintenance 6		-
BME 130T Heating and Air Conditioning -		6
CAPP 120 (CRT 100) Introduction to Computers 2		-
M 111 (MAT 110T) Technical Mathematics 3		-
PSYX 163 (PSY 105T) Work Attitudes -		1
WRIT 121 (WTS 115) Introduction to Technical Writing or WRIT 095 (WTS 100) Developmental Writing -		3
Total	17	18

Carpentry - Certificate of Applied Science and A.A.S. Degree

The mission of the Carpentry Program is to provide the regional workforce with credentialed, skilled and competent carpenters and to be responsive to emerging workforce needs.

The Carpentry program provides students the opportunity to learn carpentry skills in a competency-based learning environment. Students work hand-in-hand with professional carpenters both on campus and at construction sites.

Students use hand and power tools with blueprints to build foundation forms, frame buildings, side and roof buildings, and apply roofing materials. They install windows, doors, stairs, attic vents, insulation, vapor barriers, and drywall. Students learn methods for installing trim, locksets, suspended ceilings, countertops, cabinets, and flooring. They also learn to operate forklifts, generators, compressors, and compactors.

In addition to general education courses, students in the program learn the various steps of becoming a carpenter, including safe practices. Students construct real-world projects and can earn a Certificate of Applied Science or an Associate of Applied Science degree from the University of Montana. The program often has a waiting list. Prospective students are encouraged to apply one year prior to anticipated school attendance. Contact Donnie Laughlin, Program Director, at 406-243-7692 or Donnie.Laughlin@umontana.edu for more information.

First Year	A	S
CAR 120T Framing Carpentry Lecture	4	-
CAR 121T Framing Carpentry Lab	3	-
CAR 130T Concrete Carpentry	4	-
CAR 131T Concrete Carpentry Lab	4	-
CAR 140T Exterior and Interior Finish Carpentry	-	4
CAR 141T Interior and Exterior Finish Carpentry Lab	-	5
BUS 242T Supervision	-	3
CAPP 120 (CRT 100) Introduction to Computers	2	-
M 111 (MAT 110T) Technical Mathematics	-	3
WRIT 101 (WTS 101) College Writing I	-	3
Total	17	18

Successful completion of the courses listed above results in the award of a Certificate of Applied Science in Carpentry.

Second Year	A	S
CAR 220T Advanced Carpentry Lecture	-	4
CAR 221T Advanced Carpentry Lab	-	3
CAR 230T Building Management	3	-
CAR 231T Building Management Lab	3	-
CAR 236T Building for Solar Energy	3	-
CAR 240T Alternative Construction Materials	3	-
CAR 241T Applied Building Practices Lab	-	6
CRT 182T Computer Aided Design & Drafting.	2	-
WEL 119T Welding for Carpenters	-	2
Total	14	15

Successful completion of the first and second year courses listed above results in the awarding of an Associate of Applied Science Degree in Carpentry.

Diesel Technology- A.A.S. Degree

The mission of the Diesel Technology Program is to provide the regional workforce with credentialed, skilled and competent diesel technicians and to be responsive to emerging workforce needs.

Students in the Diesel Technology program train to be diesel mechanics that repair diesel-powered trucks and heavy equipment. Students study hydraulics, electrical systems, fuel systems, power trains, air conditioning, brakes and suspension, engine theory, and engine diagnosis, beginning with basic principles and proceeding to an advanced level of system technology. Along with these core courses, students take classes in welding, machining, computers, communications, and math. Credit for independent study is available to those desiring additional instruction in diesel mechanics. Students who complete the program successfully are awarded the Associate of Applied Science degree.

The program often has a waiting list. Prospective students are encouraged to apply one year prior to anticipated school attendance. Contact the Jim Headlee, Program Director, at 406-243-7648 or Jim.Headlee@umontana.edu for more information.

Autumn Entry:

First Year		A		S
CAPP 120 (CRT 100)	-		2	
Introduction to Computers				
DET 120T Electrical Systems	-		8	
DET 128T Engine Service I	4		-	
DET 135T Power Trains	7		-	
M 111 (MAT 110T) Technical Mathematics	-		3	
MPR 115T Related Metals Processes	-		3	
PSYX 161S (PSY 110S) Fundamentals of Organizational Psychology	3		-	
WEL 111T Welding	2		-	
Total	17		18	
Second Year		A		S
DET 221T Brakes, Suspension, and Undercarriage	6		-	
DET 225T Hydraulics	6		-	

DET 229T Engine Service - II	-	7
DET 230T Air Conditioning	-	3
DET 231T Fuel Systems	-	5
DET 235T Advanced Power Trains	-	2
TRK 106T Commercial Driver's License (CDL) Training (offered intermittently)	-	(1)
WEL 139T Welding Maintenance and Repair	2	-
WRIT 121 (WTS 115) Introduction to Technical Writing	3	-
Total	17	17-18

Power Generation

(Not available in 2009-2010)

Power generation has become a major industry within the overall diesel industry with many companies needing qualified generator technicians to service, test and repair gaseous powered systems. A University of Montana College of Technology diesel technology student may enroll in the power generation option upon successful completion of the two year diesel program, or a perspective student with industry related experience may petition to join the program. The power generation student can expect to be introduced to the concept of gas powered generators, controls, general setup/ testing and troubleshooting techniques. Generator tear-down and assembly is experienced enhancing the student's ability to understand the operation and overhaul principles of a power generator. Students also will experience operation, set-up and adjustment of typical fuel systems as found on gaseous powered generator systems including diagnostic principles. Common types of control units also will be covered with control safety of the system being the primary consideration.

Summer Session	Credits
DET 270T Diesel and Gaseous Fueled Engines	3 cr.
DET 271T Power Generators	5 cr.

Heavy Equipment Operation-Certificate of Applied Science

The mission of the Heavy Equipment Operation Program is to provide the regional workforce with credentialed, skilled and competent heavy equipment operators and to be responsive to emerging workforce needs. The Heavy Equipment Operation Program provides students a basic understanding of fundamental machine functions and is designed to develop apprentice-level skills in the operation of heavy equipment.

Students are trained to safely and properly operate and maintain a variety of heavy equipment, including crawler-tractors, graders, scrapers, front-end loaders, excavators, backhoes, and dump trucks. Students develop an understanding of basic surveying techniques, receive extensive training in safety regulations and procedures, and learn how to handle controls precisely and judge distances accurately. The program also promotes an awareness of potential job site difficulties and allows students to gain knowledge of the work ethic expected by employers in the construction industry.

A Certificate of Applied Science is awarded after the program is successfully completed.

The program often has a waiting list for admittance. Prospective students are encouraged to apply one year prior to anticipated school attendance. Contact Rod Frost, Program Director, at 406-243-7843 or Rodney.Frost@umontana.edu for more information.

Autumn Entry	A	S
CAPP 120 (CRT 100) Introduction to Computers	2	-
HEO 140T Basic Surveying	2	-
HEO 146T Safety and Basic Controls	5	-
HEO 148T Operational Skill Building	5	-
HEO 150T Job Simulation	-	6
HEO 151T Service and Maintenance	2	-
HEO 153T Construction Theory and Specialized Equipment	-	5
M 111 (MAT 110T) Technical Mathematics	3	-
MPR 112T Related Metals Processes	-	1
PSYX 163 (PSY 105T) Work Attitudes	-	1
TRK 106T Commercial Truck Driving License Training (offered intermittently)	(1)	-
WRIT 121 (WTS 115) Introduction to Technical Writing or WRIT 095 (WTS 100) developmental Writing	-	3
Total	20	16

Recreational Power Equipment-Certificate of Applied Science

The mission of the Recreational Power Equipment Program is to provide the regional workforce with credentialed, skilled, and competent power equipment technicians and to be responsive to emerging workforce needs.

The Recreational Power Equipment Program prepares students to repair and maintain a wide variety of two-cycle and four-cycle engines and related equipment. Students work on motorcycles, ATVs, snowmobiles, outboard motors, and personal watercraft. Units of instruction include mechanical, fuel, and electrical systems. The program also encourages the development of teamwork and interpersonal skills required on the job.

For more detailed information including program costs, tool requirements, student class schedules, and course syllabi, visit: www.cte.umt.edu/departments/industrial/rec_power

Credit for independent study is available to those desiring additional instruction in recreational power equipment. Contact Mike Steffenson, Program Director, at 406-243-7693 or Michael.Steffenson@umontana.edu for more information.

Autumn Entry	A	S
CAPP 120 (CRT 100) Introduction to Computers	2	-
M 111 (MAT 110T) Technical Mathematics	-	3
MPR 115T Related Metals Processes	3	-
PSYX 163 (PSY 105T) Work Attitudes	-	1
SET 160T Basic Electricity	3	-
SET 176T Motorcycle/ATV Engines, Suspension, and Chassis	3	-
SET 177T Motorcycle/ATV Electrical and Fuel Systems	4	-
SET 178T Marine Electrical and Fuel Systems	-	4
SET 179T Marine Powerheads and Lower Units	-	6
SET 180T Snowmobile Maintenance and Repair I	2	-
SET 181T Snowmobile Maintenance and Repair II	-	2
SET 182T Computer Applications for Motor Sports	-	1
WRIT 121 (WTS 115) Technical Writing or	-	3

Welding Technology - Certificate of Applied Science and A.A.S. Degree

The mission of the Welding Technology Program is to provide the regional workforce with credentialed, skilled, and competent welders and to be responsive to emerging workforce needs. The Welding Technology Program prepares students to operate and troubleshoot a variety of welding power sources and related equipment. The program prepares students to solve problems found within the welding industry using computational skills and other problem-solving techniques essential to welding and steel fabrication. It also encourages the development of teamwork and interpersonal skills required on the job.

Welding students develop skills in six different welding processes—oxyacetylene (OAW), shielded metal arc (SMAW), gas metal arc (GMAW), flux core arc, (FCAW), submerged arc (SAW), and gas tungsten arc welding (GTAW). Beyond the development of welding skills and understanding of the process, they also study other vital skills, such as blueprint reading and layout skills, metallurgy, and gain an understanding of how heating and cooling cycles affect the properties of metals. Students also study the design of jigs and fixtures and how to incorporate these into an automated welding system.

The Welding Technology Program also has courses that provide for a solid background in the metals industry. Such courses are Computer Aided Design and Drafting (CADD), OSHA Rules and Compliance, and Related Metals Processes. Metals Fabrication I & II utilize all of the gained knowledge with an instructor approved/student designed project.

Welding technology students have the opportunity to become certified to American Welding Society Standards and receive documentation stating qualifications.

Students are awarded the Certificate of Applied Science upon successful completion of the first year of the Welding Technology program. Students are awarded the Associate of Applied Science degree upon successfully completing the two-year program.

The program often has a waiting list. Prospective students are encouraged to apply one year prior to their anticipated school attendance. For more detailed information including program costs, tool lists, class schedules, and course syllabi, visit our web site at: www.cte.umt.edu/department/industrial/welding_technology, or contact Bob Shook, Program Director, at 406-243-7644 or Bob.Shook@umontana.edu

Autumn Entry:

First Year	A	S
CAPP 120 (CRT 100) 2 Introduction to Computers	-	
M 111 (MAT 110T) 3 Technical Mathematics	-	
MPR 114T Related Metals 3 Processes	-	

PSYX 163 (PSY 105T)	-	1
Work Attitudes		
WEL 180T Welding Metallurgy	4	-
WEL 181T Shielded Metal Arc Welding (Plate) and Thermal Cutting	4	-
WEL 182T Blueprint Reading and Development	-	3
WEL 194T Layout Techniques	2	-
WEL 184T OSHA Rules and Compliance	-	1
WEL 185T Flux Core Arc Welding	-	4
WEL 189T Metal Fabrication I	-	4
WEL 195T Special Topics	-	(1)
Total	16	14

Successful completion of the courses listed above results in the award of a Certificate of Applied Science in Welding.

		A	S
Second Year			
BUS 242T Supervision	-	3	
CRT 182T Computer Aided Design and Drafting	2	-	
MPR 214T Advanced Related Metals Processes	3	-	
WEL 280T Gas Tungsten Arc Welding	4	-	
WEL 281T Metal Fabrication II	-	4	
WEL 282T Pipe Welding-SMAW and GTAW	4	-	
WEL 283T Gas Metal Arc Welding	-	4	
WEL 285T Automation in Welding	-	3	
WEL 286T Welding Certification and Codes	-	2	
WRIT 121 (WTS 115) Introduction to Technical Writing	3	-	
Total	18	16	

Courses

U = for undergraduate credit only. R after the credit indicates the course may be repeated for credit to the maximum indicated after the R. Credits beyond this maximum do not count toward a degree.

Building Maintenance (BME)

U 122T Electricity 6 cr. Offered spring. The electrical laws and principles pertaining to DC and AC circuits. Includes current, voltage, resistance, power, load, panels, feeders, lamps, motors, and fuses. Introduction to wiring methods and materials in conformance with the National Electric Code (NEC). Includes installation and replacement of light fixtures, heaters, GFCI's, switches, receptacles, and electrical thermostats.

U 123T Carpentry 6 cr. Offered autumn. Application of carpentry principles and techniques. Construction and maintenance of foundation, floor, wall, ceiling, and roof systems. Includes safe use of tools and materials common to the industry. Additional topics are painting, masonry, insulation, and ventilation of commercial buildings.

U 127T Low Pressure Boilers 3 cr. Offered spring. The fundamentals of low pressure boiler operation and maintenance. Covers steam, feed-water, fuel, and draft systems. Includes boiler water treatment and hot water heating systems. Introduces safe mechanical operating procedures used in the industry.

U 128T Maintenance 6 cr. Offered autumn. Maintenance principles pertaining to lawns, groundcovers, trees, swimming pools, plumbing, and building cleaning. Emphasis is placed on safe application of chemicals; maintenance frequency; and the identification and safe uses of associated tools and materials.

U 130T Heating and Air Conditioning 6 cr. Offered spring. The fundamentals of heating, ventilating, and air conditioning. Covers heating and refrigeration cycles, gas furnaces, refrigerants, system evacuation and charging, and components used in associated systems. Introduces the basic mechanical service procedures used in the industry.

U 228T Machine and Equipment Installation 2 cr. Offered spring. Tools and procedures for installing, leveling, and aligning equipment and machinery. Mechanical advantage formulas presented in physics are demonstrated. Included are safe loads for ropes, jacks, slings, and blocks and tackles. Skills pertaining to the proper use of ladders, scaffolds, safety belts, and life nets used in maintenance work are discussed.

Carpentry (CAR)

U 120T Framing Carpentry Lecture 4 cr. Introduction to the carpentry trade, including history, career opportunities, and requirements. The course covers building materials, fasteners, adhesives, hand tools, and power tools. Students learn about and are required to build a small building with a floor, walls, ceiling, and a roof. Windows and exterior door are also installed.

U 121T Framing Carpentry Lab 3cr. Lab to accompany CAR 120T.

U 130T Concrete Carpentry 4 cr. This course includes advanced blueprint reading, material estimating, site layout, measurement, and differential leveling. Concrete forms are constructed, including continuous, pier, grade beam, slabs, and footings. Form application and construction methods are demonstrated. Cutting, bending, splicing, and

tying of reinforcing steel is required. Students learn methods for handling, placing, and finishing concrete. Manufactures forms are introduced for walls, columns, deck slabs, roof slabs, beams, and girders.

U 131T Concrete Carpentry Lab 4 cr. Lab to accompany CAR 130T

U 140T Exterior and Interior Finish Carpentry 4 cr. Study of various types of siding, gutter systems, roof venting requirements, and framing with metal studs. Installation of sheathing, exterior siding, roofing felt, shingles, insulation vapor barriers, and stairs on small building constructed in Carpentry 1. Installation of wood and metal doors including frames, locksets, and closers. Demonstration of materials, layout and installation of suspended ceilings. Selection and installation of countertops, base cabinets and wall cabinets. Window, door, floor, ceiling trim and drywall are installed in a small building

U 141T Interior and Exterior Finish Carpentry Lab 5 cr. Lab to accompany CAR 140T.

U 195T Special Topics 1-6 cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 196T Independent Study variable cr. (R-6) Offered intermittently

U 220T Advanced Carpentry Lecture 4 cr. The process of angular measurement, using transits, theodolites, electronic distance measuring devices, lasers, and trigonometric calculating to lay out foundations and determine elevations. Installation of standing seam, lap seam, and built-up roofing systems; concrete, vinyl, wooden, tile, and carpeted floors as well as radiant heating; paneling, wainscoting, movable partitions, curtain walls and fire-rated commercial wall construction. Advanced stair systems, including shop built and prefabricated stairs, balustrades, mitered risers and treads, and layout of elliptical fastening methods, and assembly techniques. Project planning, scheduling, estimating, and management skills included.

U 221T Advanced Carpentry Lab 3 cr. Laboratory to accompany CAR 220T.

U 230T Building Management 3 cr. Introduction to building business and project management including overhead costs, payroll costs, estimating and scheduling. Covers elements of payroll computation and preparation, payroll tax returns, information returns, and identification and compensation of independent contractors. Students are introduced to building cost estimating, and scheduling of subcontractors and building inspections.

U 231T Building Management Lab 3 cr. Laboratory to accompany CAR 130T.

U 235T Building Energy Conservation 3 cr. Study of the analysis techniques used for reduction of energy consumption and energy management, including energy accounting and energy auditing. Residential and commercial building energy efficiency opportunities will be covered. Other topics addressed include motors, pumps, green building, and purchasing energy supplies. Career opportunities in energy efficiency will be discussed.

U 236T Building for Solar Energy 3 cr. Study of the basics of solar energy and design with emphasis on passive solar applications. The elements and design patterns for successful passive solar buildings are covered in detail. Design requirements for solar generated electricity and solar heated water are considered. Also covered are designing new and remodeled buildings to be solar ready, solar retro-fits, and other applications.

U 240T Alternative Construction Materials 3 cr. Review of alternative construction materials and other alternative building materials, as well as building materials using

recycled components. Re-use of salvaged materials and use of nontraditional building methods such as straw bale and rammed earth construction will be covered.

U 241T Applied Building Practices 6 cr. Offered spring. Prereq., CAR120T, 121T, 130T, 131T, 140T, 141T. Students work on a variety of projects either at the college or in the community to practice and develop their skills as well as learn new skills. Knowing and following OSHA rules and regulations is emphasized. Expectation of professional quality product.

Diesel Technology (DET)

U 120T Electrical Systems 8 cr. Offered spring. The theory of AC/DC electricity including Ohm's Law, magnetism, wiring diagrams, and circuit analysis. Starting, charging, and related systems are covered in-depth using test equipment commonly found in heavy equipment repair facilities. Electronic systems are reviewed and tested using common electronic test equipment.

128T Engine Service I 4 cr. Offered autumn. Introduction to the construction and operation of internal combustion engines with the diesel engine being examined in detail. The use of measuring tools and related special tools is covered extensively along with common manufacture rebuild procedures. Start-up and running practices are demonstrated on various running diesel engines.

U 135T Power Trains 7 cr. Offered autumn. Chassis and drive train components used in light and heavy-duty trucks and other equipment. Clutches, manual transmissions, differentials, and final drives are covered.

U 196T Independent Study Variable cr. (R-6) Offered every term.

U 221T Brakes, Suspension, and Undercarriage 6 cr. Offered autumn. Air brake design, construction, and operating principles including an in-depth study of diagnostic procedures for troubleshooting and repairing brake systems. Suspension systems and undercarriage design and repair are covered along with common axle alignment procedures found in industry.

U 225T Hydraulics 6 cr. Offered autumn. Theory and application of hydraulics relative to mobile construction equipment and industrial hydraulic systems. Includes valves, pumps, motors, actuators, and related hydraulic components, system maintenance, troubleshooting, and repair.

U 229T Engine Service II 7 cr. Offered spring. Prereq., DET 128T. A continuation of Engine Service I with a major emphasis placed on the rebuilding of a diesel engine. Engine components repair and failure analysis are reviewed along with tune-up and running of diesel engines commonly found in the heavy equipment trade. Shop flat-rate procedures, work order procedures, and warranty requirements are covered.

U 230T Air Conditioning 3 cr. Offered spring. Prereq., DET 120T, DET 225T. Principles, theories, and the hazards of working with R-12 and R-34, including laws governing these refrigerants. An in-depth study of the components of an air conditioning system including hands-on practice. Discharging and charging principles are discussed, including leakage testing and other general diagnostic principles found in the field.

U 231T Fuel Systems 5 cr. Offered spring. A comprehensive study of diesel fuel injection systems to include: Cummins, Roosa Master, Caterpillar, Detroit Diesel, and Bosch. Disassembly and repair of these systems are covered in-depth along with calibration practices. Installation, timing, and on-engine adjustments are made on diesel engines.

On-engine diagnosis of the fuel systems using special diesel engine diagnostic tools is reviewed.

U 235T Advanced Power Trains 2 cr. Offered spring. Prereq., DET 135T. A continuation of DET 135T with an emphasis on heavy automatic transmission, torque converters, and powershift transmission. In-depth coverage of component review troubleshooting and repair.

U 270T Diesel and Gaseous Fueled Engines 3 cr. Offered summer. Prereq., completion of an accredited diesel program or consent of instr. Overview of the diesel engine and its operating principles including the fuel systems found in the power generation field. Both mechanical and electronic type systems studied in depth. Gaseous/spark ignited internal combustion with in-depth look at both the ignition system and fuel system. Emission systems, preventive maintenance and general tune-up included.

U 271T Power Generators 5 cr. Offered summer. Prereq., completion of accredited diesel program and DET 270T. Introduction to generators as found in the power generation field including the review of electrical laws that pertain to A/C and D/C current. The operation of a typical internal combustion powered generator will be covered in depth including troubleshooting and rebuilding practices found in the power generation field. Generator mounting/alignment practices and generator installations, including flow requirements for combustion and cooling.

U 272T Power Generation Controls 4 cr. Offered summer. Prereq., completion of accredited diesel program and DET 271T. Operation of the generator and controls including governing devices and other specialized devices such as reverse power relays and volt/amp reactive power factor (VAR) controllers. Intensive troubleshooting including in depth coverage of service and repair of control systems.

Heavy Equipment Operation (HEO)

U 140T Basic Surveying 2 cr. Offered autumn. Basic principles of surveying and the use of surveying equipment. Calculation of angles and distances to determine grade elevations. Introduction to Global Positioning Systems, lasers and their relationship to the heavy equipment operator.

U 142T Basic Surveying II 1 cr. Offered spring. Prereq., HEO 140T. Students' plan and layout projects undertaken by the program within the community. The students participate in staking and controlling the project by using skills acquired in HEO 140T. Emphasis is on earthwork surveying.

U 146T Safety and Basic Controls 5 cr. Offered autumn. Orientation to the safe operation and basic control of crawler-tractors, scrapers, front-end loaders, motor graders, backhoes, trucks, and other heavy equipment units. Sufficient time is allowed for the development of basic machine operational skills.

U 148T Operational Skill Building 5 cr. Offered autumn. Prereq., HEO 146T. Advancement of basic skills. Proper understanding and operation of heavy equipment is pursued. Time is allowed for development of proper operational techniques.

U 150T Job Simulation 6 cr. Offered spring. Prereq., HEO 146T, HEO 148T. Incorporates learned skills into entry-level, industrial situations. Emphasis is on advanced equipment usage, problem definition and resolution, project-type earth moving assignments, proper equipment, and safety regulations. Course may allow participation in cooperative project efforts within the community.

U 151T Service and Maintenance 2 cr. Offered autumn. Different types of lubricants and their applications, scheduled and preventive maintenance procedures, and importance of periodic services and maintenance. Also included are safety procedures and regulations.

U 153T Construction Theory and Specialized Equipment 5 cr. Offered spring. Prereq., M 111 (MAT 110T). Study of construction principles, specialized equipment, production estimates, and various related subjects.

Metals Processes (MPR)

U 112T Related Metals Processes 1 cr. Offered spring. Use of hand tools and machines which relate to the repair of heavy equipment. Instruction covers fasteners, layout, bench metal, threads and threading, drills and drilling, and tool sharpening.

U 114T Related Metals Processes 3 cr. Offered autumn. Instruction and use of drills, files, threads and threading processes, basic lathe, drill press, and band saw operation, including precision measuring instruments. Fasteners, layout procedures, and basic hand tools are covered.

U 115T Related Metals Processes 3 cr. Offered autumn and spring. A basic metalworking course covering fasteners, layout, bench metal, heat treating, threads and threading, drills and drilling, basic machining, and tool sharpening.

U 214T Advanced Related Metals Processes 3 cr. Offered autumn. Prereq., MPR 114T or 115T. Advanced skill development using machine tools such as milling machines, lathes, surface grinders, and drill presses, emphasizing safety and providing greater complexity than provided in MPR 114T. Welding and machining are used together demonstrating how sequencing work improves quality and productivity.

U 196T Independent Study Variable cr. (R-6) Offered intermittently. Prereq., consent of instr.

Small Engine Technology (SET) (Recreational Power Equipment)

U 160T Basic Electricity 3 cr. Offered autumn. The theory of AC/DC electricity including Ohm's Law, magnetism, series circuits, parallel circuits, the use of meters, and electrical test equipment. Includes electrical symbols, soldering, storage batteries, cranking motors, and electrical safety.

U 176T Motorcycle/ATV Engines, Suspension, and Chassis 3 cr. Offered autumn. Study of the design and function of several types of engines, transmissions, suspension, and brake systems.

U 177T Motorcycle/ATV Electrical and Fuel Systems 4 cr. Offered autumn. Prereq., SET 160T. Principles of ignition, charging, and cranking systems. Design and function of carburetor, fuel injection, and lubrication systems. Hands-on diagnosis of problems and testing of systems.

U 178T Marine Electrical and Fuel Systems 5 cr. Offered spring. Prereq., SET 160T. Theory of and testing and troubleshooting of problems with ignition, charging, and cranking systems. Includes the design, testing, and troubleshooting of marine carburetion and fuel injection systems.

U 179T Marine Powerheads and Lower Units 6 cr. Offered spring. Prereq., SET 178T. Theory of design, function and components of outboard motor powerheads and lower

units. Includes basic rigging, power trim and tilt, propping, and personal watercraft design, function, and maintenance.

U 180T Snowmobile Maintenance and Repair I 2 cr. Offered autumn. Prereq., SET 177T. The repair and maintenance of air cooled and liquid cooled engines. Includes clutch, track, and rear suspension service and maintenance.

U 181T Snowmobile Maintenance and Repair II 2 cr. Offered spring. Prereq., SET 180T. Principles and theory of snowmobile electrical, fuel, front suspension, and brake systems.

U 182T Computer Applications for Motorsports Professionals 1 cr. Offered spring. Prereq., CRT 100. Use of recreational power equipment software for parts retrieval, invoicing and payment methods. Students build, query, and create reports using database software, and create a business plan for a hypothetical dealership.

U 195T Special Topics 1-6 cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 196T Independent Study Variable cr. (R-6) Offered intermittently.

Truck Driving (TRK)

U 106T Commercial Driver's License (CDL) Training 1 cr. Offered intermittently. Prereq., consent of instr. Individual schedule. Truck safety, operation, and maintenance review. Schedule and obtain Class A Commercial Driver's License (CDL).

Welding Technology (WEL)

U 111T Welding 2 cr. Offered autumn. Basic and intermediate processes of shielded metal arc welding (SMAW) and oxyacetylene welding are covered in flat, horizontal, and vertical positions in a variety of joint configurations. Instruction in the oxyacetylene cutting process.

U 119T Welding for Carpenters 2 cr. Offered spring. Basic welding processes of shielded metal arc welding (SMAW), flux core arc welding (FCAW) are covered in the flat, horizontal, and vertical positions in a variety of joint configurations. The instruction in flux core arc welding is focused on the carpentry building trades. Instruction in the oxyacetylene cutting process is also provided. Safe operation of equipment is covered and work is evaluated to industrial standards. This course is designed for carpentry students.

U 139T Welding Maintenance and Repair 2 cr. Offered autumn. Prereq., MPR115T, WEL 111T. Combines the skills gained in welding and machine shop for practical applications such as repairing a broken cylinder block. Major emphasis is placed on repair techniques. Common repair procedures using machine shop and welding equipment is demonstrated.

U 180T Welding Metallurgy 4 cr. Offered autumn. Covers the manufacturing of iron and steel. Examination of physical and mechanical properties. Phase changes with the application of heating and cooling cycles. Ferrous crystal types and properties. Suggested welding procedures for low, medium, and high carbon steels, alloy steels, and cast iron.

U 181T Shielded Metal Arc Welding (Plate) and Thermal Cutting 4 cr. Offered autumn. Theory and safe operation of shielded metal arc welding (SMAW) of carbon steel on plate and structural components in all positions to industry standards. Visual inspection and destructive testing used to determine acceptability based upon industry standards (American Welding Society Structural Welding Code-Steel). Power sources and electrodes are covered in depth. Materials are prepared using mechanical plate shears and thermal cutting techniques. Thermal cutting techniques are examined relative to theory of operation and safe practices. Processes used are oxy-fuel cutting, plasma arc cutting, and air carbon arc cutting. Theory and operation of oxyacetylene welding examined.

U 182T Blueprint Reading and Development 3 cr. Offered spring. Prereq., WEL 183T. Practical experience in reading and drawing orthographic projections, interpreting dimensions, notes, scales, and welding symbols. Isometric projection (pictorial), sections, and auxiliary views with practical experience using conventional drafting tools and computer aided drafting (CAD).

U 183T Layout Techniques 2 cr. Offered autumn. Encompasses layout on material of various shapes using blueprints and practical layout techniques on pipe and structural steel. Use of contour markers and a review of geometric construction. Computation of approximate costs is included.

U 184T OSHA Rules and Regulations 1 cr. Offered spring. Study of the Occupational Safety and Health Administration rules and regulations that affect the welding and construction industries.

U 185T Flux Core Arc Welding 4 cr. Offered spring. Theory, practice, and safe operation of flux core arc welding equipment. Coupons are welded in the flat, horizontal, and vertical positions to industry standards using a variety of welding electrodes, diameters, and power sources, which prepare students for welding qualification to the American Welding Society Structural Welding Code specifications.

U 189T Metal Fabrication I 4 cr. Offered spring. Prereq., MPR 114T; WEL 181T; coreq., WEL 182T, 185T. Conception, design, and construction of a metal structure to industry standards using shears, presses, and other machine tools common to the welding industry. Skills are developed in the areas of shielded metal arc welding and flux core arc welding, oxyacetylene cutting, plasma arc cutting, and air carbon arc cutting.

U 195T Special Topics 1-6 cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.

U 196T Independent Study Variable cr. (R-6) Offered intermittently.

U 280T Gas Tungsten Arc Welding 4 cr. Offered autumn. The theory and safe operation of Gas Tungsten Arc Welding (GTAW). Examination of power source controls and operation along with associated consumables such as gasses, electrode filler materials for carbon steel, stainless steel, and aluminum. Welding skill development according to industry standards using these materials in the flat, horizontal, and vertical positions.

U 281T Metal Fabrication II 4 cr. Offered spring. Prereq., MPR 114T, MPR 214T; WEL 181T, 185T, 182T, 183T, 280T, 283T. Students combine all knowledge and skills developed in the welding program to design and draw a full set of plans (blueprints) for an instructor-approved project using extensive welding, metal fabrication equipment, machining processes and automation. High quality performance, consistent with business and industry required.

U 282T Pipe Welding-SMAW and GTAW 4 cr.Offered autumn. Prereq., WEL 181T; coreq., WEL 280T. Emphasis on skill development in the welding of pipe sections to extremely high quality levels as required by national codes and standards. Pipe welding using GTAW for the root pass and SMAW for the remaining passes in all positions. Visual inspection and destructive testing used to evaluate work according to industry standards.

U 283T Gas Metal Arc Welding 4 cr.Offered spring. Prereq., WEL 185T. Theory and safe operation of Gas Metal Arc Welding (GMAW). Theory of flux core arc welding applied to GMAW. Primary focus on application, practical skill development, and producing welds that meet industry standards. Metals welded are low carbon steel, stainless steel, and aluminum. Short circuit arc and spray arc transfer used. Examination of gas and electrode selection.

U 285T Automation in Welding 3 cr.Offered spring. Application of the welding process to automation. Examination of simple automation techniques such as tools, clamping, and fixturing to aid in the rapid joining of production runs. Increasing complexity is examined leading into equipment that carries the welding gun, tractors, and carriages by fully automated systems with the student performing set-up and troubleshooting (Submerged Arc Welding) and automated parts processing (optical tracer torch). Programmable controllers are investigated and used. Programming and use of a PUMA 650 Industrial Robot.

U 286T Welding Certification and Codes 2 cr.Offered spring. Prereq., WEL 181T, 185T. Fundamental concepts and requirements of the American Society of Mechanical Engineers (ASME) and American Welding Society (AWS) are examined. Through laboratory experience students are provided the opportunity to qualify (certify) under the two codes mentioned above.

U 295T Special Topics 1-6 cr. (R-6) Offered intermittently. Experimental offerings of visiting professors, experimental offerings of new courses, or one-time offerings of current topics.