



Wright Technical Center

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Course Syllabus 2026-2027

Program

Heavy Equipment Operations & Maintenance

Grade Level

11th & 12th Grade

Instructor

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Concurrent Courses (MNVA)

CAR022 - Construction Exploration (Trimester 1,2 & 3)
MFG201 - Equipment Fundamentals (Trimester 1)
MFG202 - Mobile Equipment Maintenance (Trimester 2)
MFG010 - Basic Grade (Trimester 3)

Course Description

This enhanced hands-on work experience course is an introduction to the applied skills needed in the Heavy Equipment Operations and Maintenance industry. Students will experience hands-on career related activities, heavy equipment simulators, industry tours & speakers, and investigate careers associated with the Heavy Equipment field. Students will be concurrently enrolled in classes through an online provider (MNVA):

- **Construction Exploration** - This course provides students with an introduction of the basic equipment used in the construction industry. Students learn about basic equipment operations and job responsibilities. This course prepares students to use concepts pertaining to safety, maintenance, mathematics and communication that Operating Engineers may experience.
- **Basic Grade & Construction Math** - In the construction industry, grading is the work of ensuring a level base, or a grade with a specific slope. Grade construction work is needed in almost any building project, from laying a building foundation, to landscaping, or even roadwork. In this course, you will be introduced to core equipment used in the staking process, as well as Personal Protective Equipment (PPE) used in the construction industry. Communication processes used in the construction industry for interpreting and setting grade are also an important part of this course. Finally, you will learn mathematical concepts related to the construction industry for grade staking.
- **Basic Construction & Equipment Fundamentals** - In the construction industry, the proper use of heavy equipment is necessary to ensure quality work and a safe work environment. In addition, being able to recognize and determine the use of specific heavy equipment, will create a more efficient work team. Heavy equipment is used in almost any construction project, from building a house to excavating for a new road. In this course, you will be introduced to core equipment used by operating engineers, as well as their maintenance needs. Communication processes used by operating engineers, rigging and signaling practices, safety awareness and mathematical concepts related to the construction industry are also covered.
- **Basic Maintenance of Mobile Equipment** - This course focuses directly on maintenance of mobile equipment through a series of engaging tutorials. A major focus of the course is on maintenance safety including such topics as LOTO. Other topics include tools and fasteners, preventative maintenance principles, engines, intake and exhaust, fuel systems, coolant systems, filters and filtration, lubrication systems, hydraulics, electrical systems, tires, and tracks and undercarriages.

Textbook & Classroom Resources

- Duffy, O.C., Heard, S.A., & Wright, G. (2019). *Fundamentals of Mobile Heavy Equipment*. Jones & Bartlett Learning.
- International Union of Operating Engineers Local 49. (n.d.). *Operating Engineers Pathway*. <https://local49.org/pathway/>
- Minnesota Virtual Academy. *Heavy Equipment Online Curriculum*. Houston Public Schools, Houston, MN : Stride Career Prep
- National Center for Construction Education and Research. (2024). *Heavy Equipment Operations: Level 1 (4th ed.)*. Pearson
- National Center for Construction Education and Research. (2024). *Heavy Equipment Operations: Level 2 (4th ed.)*. Pearson

Course Topics

Safety

- Personal & Worksite Safety
- OSHA 10 & SP2 Safety Trainings
- Personal Protective Equipments (PPE)

Career Research

- Operating Engineers Pathway
- Related Heavy Equipment & Maintenance Careers
- Industry Speakers & Tours

Construction Worksite

- Reading Site Plans
- Grading & Slope

Heavy Equipment Operations

- Heavy Equipment (Machine) Identification
- Equipment Pre-Start Inspections
- Use of Hand Signals
- Equipment Use - *safely perform assigned activities and tasks*
 - Excavators
 - Loaders / Skid Steers
 - Forklift

Heavy Equipment Maintenance

- General Shop Practices
 - Identify personal protective equipment (PPEs)
 - Complete OSHA-10 & SP2 safety trainings
 - Select and use sealants properly
 - Describe proper use of hand tools
 - Demonstrate safe use of jacks and lifting equipment
- Preventive Maintenance
 - Inspect and maintain tire & track performance
 - Monitor gauges and warning lights
 - Identify major components of heavy equipment systems - *see below*
 - Inspect & maintain heavy equipment systems - *see below*

- Adhere to maintenance schedules and manage record keeping
- Measure and maintain oil and fluid levels
- Perform oil sampling

- Engine
 - Identify engine components
 - Inspect & maintain engine
 - Change oil and filters
 - Maintain fuel system
 - Apply knowledge of 4-stroke engines
 - Maintain cooling system
 - Maintain intake and exhaust systems

- Powertrain
 - Identify powertrain components
 - Inspect & maintain powertrain
 - Demonstrate knowledge of hydrostatic powertrain
 - Service final drives
 - Service power shift transmissions
 - Service and inspect drive lines
 - Service and maintain mechanical transmissions

- Electrical System
 - Inspect & maintain electrical systems/electronic controls
 - Service and test starting system
 - Service and test charging system & battery
 - Maintain basic electrical system (lighting accessories)

- Brake Systems
 - Identify brake components
 - Inspect & maintain air brake systems
 - Apply knowledge of wet brake systems
 - Apply knowledge of hydraulic brake systems

- Hydraulic System
 - Identify basic hydraulic system components
 - Inspect & maintain Hydraulic System
 - Describe operation of various hydraulic pumps
 - Service and troubleshoot hydraulic system, valves, and pressure controls
 - Service hydraulic cylinders

- Air Conditioning System
 - Identify air conditioning components
 - Inspect & maintain air conditioning system
 - Troubleshoot air conditioning malfunctions

- Heavy Equipment Undercarriage
 - Inspect undercarriage and components
 - Demonstrate appropriate use of ground engaging equipment
 - Perform track tension adjustments
 - Demonstrate appropriate blocking/cribbing techniques

Skills Needed

To be successful in this program, you should have the following skills:

- **Must be able to work independently**
- Mechanical aptitude
- **Manual dexterity**
- Eye-hand coordination
- **Detail oriented**
- Ability to problem solve
- **Strong technical writing and reading skills**
- Strong math skills

Program Safety:

Students will complete industry and shop specific safety training before being allowed to participate in lab activities. Safety training in the Heavy Equipment program includes:

- PPE - Personal Protective Equipment Training
- OSHA 10 Training
- Use of S/P2 Online Training program
- Career Speakers focusing on site specific safety requirements and topics

Evaluation of Learning

Student performance will be evaluated using multiple assessments involving assigned program activities. Student's course grades will be based on the following:

Evaluation Criteria	Method of Evaluation	Weighted Grading
Effort & Participation	● Attendance ● Class participation ● Professionalism ● Attitude/Behavior ● Field Trips	33.3%
Performance	● Skill performance and observation checklists ● Projects	
Knowledge of Course Content	● Daily assignments	33.3%
	● Quizzes & Tests	33.4%

Late Assignments

You may earn half credit for late assignments that have been turned in within a week of their due date. All assignments more than one week late will be zeros.

Grading Scale

Grade	Percentage
A+	100% – 98%
A	97% – 93%
A-	92% – 90%
B+	89% – 88%
B	87% – 83%
B-	82% – 80%

Grade	Percentage
C+	79% – 78%
C	77% – 73%
C-	72% – 70%
D+	69% – 68%
D	67% – 63%
D-	62% – 60%
F	59% – Below

TSA Assessment

The AED Foundation (AEDF) High School Certification Test (aedfoundation.org) is an end-of-program fundamental assessment that evaluates technical knowledge of pre-hire applicants and employed technicians in the heavy equipment industry upon high school graduation. The primary function of the test is to ensure industry standards are upheld by our members, schools, and partners by identifying the strengths and weaknesses of graduating high school seniors in the six core competencies of the AEDF technical standards:

- Powertrains
- Diesel Engines
- HVAC
- Hydraulics/hydrostatics
- Electrical
- Safety

Student Organizations

Students in the Heavy Equipment program will have the opportunity to participate in SkillsUSA. The goal of SkillsUSA is to build a student's technical and leadership skills in a career area. Students who wish to participate will be able to compete at local and state events. The students will also be involved in service learning projects to better one's community.

Career Information

MN Program of Study	
Career Field	Engineering, Manufacturing & Technology
Career Cluster	Transportation, Distribution & Logistics / Architecture & Construction
Career Pathway	Facility & Mobile Equipment Maintenance / Construction
Related occupations requiring additional training or education: • Mobile Heavy Equipment Mechanics • Crane & Tower Operator • Excavating & Loading Machine Operator • Paving Equipment Operator • Dredge Operators • Mining Machine Operators	
Career Outlook	<i>information available @careerwise.minnstate.edu</i>

College Credit & Apprenticeship Opportunities

College credits can also be earned if you maintain a “B” or above grade in the course. Credits are available from the following schools:

- North Hennepin Community College
- Central Lakes College - *in process*

Students who complete the concurrent courses will earn up to 22.5 hours which may be applied towards the Operating Engineers Pathway apprenticeship (IUOE- Local 49er’s)

Visit the following website for specific articulated college courses – www.ctecreditmn.com

The **WRIGHT** path for High School