Michigan Tech

Office Memo

Office of the Provost and
Senior Vice President for Academic Affairs

Phone: (906) 487-2440
Fax: (906) 487-2935

TO: Richard Koubek, President

FROM: Andrew Storer, Provost & Senior Vice President for Academic Affairs

DATE: April 10, 2026

SUBJECT: Senate Proposal 24-26

Attached is Senate proposal 24-26, “Applied Process Control Minor,” and a memo stating the Senate passed this proposal at their April 9, 2026 meeting. I have reviewed this memo and recommend approving the proposal.

If you concur with my recommendation, the provost’s office will notify the appropriate offices as no further approvals are needed.

I concur X do not concur _____ with the provost’s recommendation as stated in this memo.

Richard Koubek, President

4/10/26
Date

University Senate

Michigan Tech

DATE:	April 9, 2026
TO:	Richard Koubek, President
FROM:	Robert Hutchinson, University Senate President
SUBJECT:	Proposal 24-26
COPIES:	Andrew Storer, Provost & Senior VP for Academic Affairs

At its meeting on April 9, 2026, the University Senate approved Proposal 24-26, "Applied Process Control Minor." Feel free to contact me if you have any questions.

The University Senate of Michigan Technological University

Proposal 24-26

Minor in Applied Process Control

Basic Program Information

Primary Contact: Jeana Collins, Chemical Engineering Curriculum Committee Chair

- With support from: Patrick Pinhero, Chair, Department of Chemical Engineering

Program/Degree type: Minor

Program Title: Minor in Applied Process Control

Planned Implementation Date: Fall 2027

Program location/modality: Face to Face

Target student population: current students: chemical engineering students interested in applied controls

General description and characteristics of program

The Minor in Applied Process Control will prepare chemical engineering students for roles directly in or working with process control, specifically plant wide control via a distributed control system (DCS). Other program students may complete the minor upon successful completion of the prerequisite courses for the required courses in the minor; however, they are not the minor's intended audience.

Three required courses make up 9 credits, or half, of the minor. CM 3310, Process Control, is a required course for the Chemical Engineering major and is a required course for the minor. The other two required courses for the minor are existing electives within the Chemical Engineering Department.

The required process control course, CM 3310, will provide foundational knowledge in process control, including:

- Basics of process control
    - Introduction to process control and automation
    - Elements of feedback control
    - On-off and PID control
- Introduction to process modeling
    - Review of ODEs
    - Stability and performance analysis: both open and closed loop
    - Stability and Performance Analysis: Closed loop
    - PID tuning
- Introduction to Transfer functions (TF) with applications in feedback control analysis and design, and other control configurations
    - Application of TFs to Basic Feedback Control Analysis and Design
    - Application of TFs to Other Control Configuration
- Some process control applications to chemical engineering unit operations including distillation, blending, and reactor control, among others.

- Basics of industrial automation
    - Introduction to automation
    - Discrete (Sequence) event control
    - Programming via sequential flow diagrams
    - Basics of programmable logic controllers (PLC)
    - Introduction to ISA 88 for batch process control
    - Simulation using STATEFLOW

The Process Dynamics and Automation class, CM 4315, will build on the foundational knowledge from CM 3310 and will introduce the students to the real-world control problems and strategies used to implement automation and control of complex chemical processes. This course will enrich students' learning by providing a strong underpinning for the basis of control in industrial systems.

Introduction to Distributed Control System Human-Machine Interfaces (Introduction to DCS HMIs), CM 4150, will build on the material learned in CM 3310 and supplement the applications covered in CM 4315, while exploring how distributed control systems work and how to program them, from adding the logic for the controls to creating and testing graphics, or human-machine interfaces (HMIs), including ANSI/ISA 101.01. DCSs are widely used across multiple industries. One of the most commonly used DCSs is DeltaV, which is the DCS used in the Unit Operations Lab in the chemical engineering department. An introduction to how the software works behind the scenes is beneficial for any students that will be working with a DCS for their job after graduation. All chemical engineering students learn how to operate pilot plants using DeltaV, but there is also interest in learning how to create the graphics and set up the controls.

The elective courses, 9 credits or half of the minor, will provide additional insight and background into general process control concepts, circuits, programming, and human factors to solidify the foundational knowledge needed in these areas to support a career in process control. The elective course requirements include a human factor course and process control course. The rest of the electives can come from the human factor list, process control list, circuits list, and programming list. All electives on these four lists currently exist at Michigan Tech, outside of the Chemical Engineering Department. Additional information regarding the curriculum and elective options is included in the Curriculum Details section of this document.

Rationale

Process control is essential in industry, and Michigan Tech provides a unique opportunity for students to gain more knowledge in process control than most schools, especially in applied process control. Our undergraduate course not only has a strong lecture component (3 credits) but also a strong hands-on component (1 credit) that builds upon and applies what the students learn in the lecture. Students reinforce their knowledge of applied process control during the capstone laboratory sequence, where they operate two pilot plants (one continuous and one batch) with a distributed control system. Dr. Kyle Griffin added a process control elective, CM 5315 Process Dynamics and Automation (3 credits) in Summer 2023 (a course originally proposed by Dr. Kurt Rickard for the Profit-Increasing Strategies Graduate Certificate), and Dr. Jeana Collins added an additional process control elective, Introduction to Distributed Control System Human-Machine Interfaces (2 credits) in Spring 2024. With the addition of these

electives, and a large number of relevant courses at Michigan Tech, a process control minor is feasible. Chemical engineering graduates having process control knowledge is something that the companies that are hiring our students value, and that many of our students are interested in.

Process control (and automation) is extremely important in industry. Having a strong process control background will make our students stand out and provide more potential opportunities for their careers. Students have been showing interest in a process control minor for years. CM 4150, Introduction to Distributed Control System Human-Machine Interfaces, was developed because of the number of students showing interest in learning more about the DCS in the Unit Operations Lab during their senior year. Many students are exposed to industrial control on their co-ops and want to go more in-depth than the base curriculum allows.

Related programs: within MTU and at other institutions

Michigan Technological University currently offers a Minor in Data Acquisition and Industrial Control in the College of Computing; there may be some overlap with this minor, but the overall scopes of the minors are different. The proposed Minor in Applied Process Control has a focus on plant-wide control, designing control systems for a plant with various interacting controllers. Multiple courses incorporate the use and programming of a distributed control system. Part of setting up a distributed control system involves considering how humans work/think and interact with a process. This is part of CM 4150, Introduction to Distributed Control System Human-Machine Interfaces, and we have a human factors requirement to help build the foundation.

To the best of our knowledge, out of the over 150 BS in chemical engineering programs in the U.S. (AIChE), there are two other chemical engineering programs in the country that have process control minors; University of Wyoming and University of Miami, Ohio. The proposed minor has similar themes in elective topics to these two minors, however, the proposed minor has less overlap with courses required for a chemical engineering major and more options available for elective choices. Subsequently, the proposed minor gives Michigan Tech students a competitive advantage to the graduates of these programs and to the other chemical engineering programs in the country that do not have a process control minor.

Projected Enrollment

Projected enrollment is 5 per year in the minor program, based on enrollment in the two new advanced controls classes, CM 5315 Process Dynamics & Automation and CM 4150 Introduction to Distributed Control System Human Machine Interfaces.

CM 4315 Enrollment (from graduate version, CM 5315):

- Spring 2026 = 15 (switched from summer class)
- Summer 2024 = 8
- Summer 2023 = 4

CM 4150 Enrollment (as special topics course CM4990)

- Spring 2026 = 5
- Spring 2025 = 5
- Spring 2024 = 10

Specialized Accreditation Requirements

There are no specialized accreditation requirements.

Professional Licensure Requirements

There are no professional licensure requirements.

Curriculum Details

Learning Goals

Upon completion of this minor, students should be able to:

- Model, analyze, design, and tune simple and complex dynamic systems
- Analyze the effectiveness of existing DCS HMIs and identify areas for improvement
- Design and build comprehensive HMIs for a distributed control system, including tracking important process variables, programming sequences, and alarm management

Assessment Plan

The three learning objectives will be assessed in the three required classes.

Learning Objective	Course(s) where assessed
Model, analyze, design, and tune simple and complex dynamic systems	CM 3310 Exam(s) CM 4315 Project
Analyze the effectiveness of existing DCS HMIs and identify areas for improvement	CM 4150 In-class Activity/Discussion
Design and build comprehensive HMIs for a distributed control system, including tracking important process variables, programming sequences, and alarm management	CM 4150 Project

Curriculum Design

All courses currently exist at Michigan Tech and are offered as in-person classes on campus except for UN3002/UN3003/UN3004. One class, CM 3310, overlaps with the Chemical Engineering major requirements. The rest of the courses can fill technical elective, free elective, and essential education requirements (see the model schedule for an example).
Total Credits: 18

Required Process Control Courses: 9 credits

- CM 3310 Process Control (4) *Prereqs: (MA 3520 or MA 3521 or MA 3530 or MA 3560) and PH 2200 and CM 2110*
- CM 4150 Introduction to Distributed Control System Human Machine Interfaces (2) *Prereqs: CM 4110*
- CM 4315 Process Dynamics & Automation (3) *Prereqs: CM 3310 or EE 3160*

Elective Courses: 9 credits
Required Human Factor Courses: select one course (3 credits minimum)

- HF 2000 Introduction to Engineering Psychology (3) *Prereqs: none*
- HF 3850 Human Factors (3) *Prereqs: (PSY2000 or HF2000) and UN1015*
- HU 3845 Human-Machine Communication (3) *Prereqs: UN1015*

Required Process Control Courses: select one course (3 credits minimum)

- EE 2174 Digital Logic and Lab (4) *Prereqs: CS 1121 or CS 1131 or CS 1111*
- EE 3160 Signals and Systems (3) *Prereqs: (EE 3010 or EE 2112) and (MA 2320 or MA 2321 or MA 2330) and (MA 3520 or MA 3521 or MA 3530 or MA 3560)*
- BE 2700 Biomedical Signals & System (3) *Prereqs: CH 1150 or CH 1112 and PH 2100 and MA 2160 and ENG 1102*
- EE 3174 Introduction to Microcontrollers and Embedded Systems (4) *Prereqs: EE 2174 and (CS 1111 or CS 1142 or CS 1121 or CS 1131)*
- EE 3261 Control Systems (3) *Prereqs: EE 3160*
- EE 4262 Digital and Non-linear Control (3) *Prereqs: EE 3261*
- Undergraduate Research (1-6) *Topic must be approved by minor academic advisor*
- UN3002/UN3003/UN3004 (1-6) *Must be approved by minor academic advisor*
- ENT 29xx/39xx/49xx Enterprise Project Work *Must be approved by minor academic advisor*

To obtain the remaining credits of the minor, students may choose from the human factors or process control course lists above, or the student may select from the courses listed below.

Circuits Courses:

- EE 3010 Circuits & Instrumentation CPS (3) *Prereqs: MA 1121 or MA 1160 or MA 1161*
- EE 2112 Electric Circuits and Lab (4) *Prereqs: MA 3520 (C) or MA 3521 (C) or MA 3530 (C) or MA 3560 (C)*
- EET 1121 Circuits 1 (3) *Prereqs: EET1122 (C), MA 1031 or MA 1032 or MA 1120 or MA 1121(C) or MA 1160(C) or MA 1161(C) or MA 1135(C)*
  and EET 1122 Circuits 1 Lab (1) *Prereqs: EET1121 (C), MA 1031 or MA 1032 or MA 1120 or MA 1121(C) or MA 1160(C) or MA 1161(C) or MA 1135(C)*

Programming Courses:

- CS 1121 Introduction to Programming I (3) *Prereqs: MA 1031(C) or MA 1032(C) or MA 1120(C)*
  - ***or*** CS 1131 Accelerated Introduction to Programming (5) *Prereqs: MA 1031(C) or MA 1032(C) or MA 1120(C) or MA 1160(C) or MA 1161(C) or MA 1121(C)*
- ENT 3981 Labview Basics (1) *Prereqs: none*

Model Schedule

The example below illustrates how the minor can be incorporated into the Bachelor of Science in Chemical Engineering degree program. Courses for the minor are highlighted.

Semester	Course	Credits	Pre-reqs	co-req
1 - Fall	CM 1000 Intro to Chemical Engineering	1		
	CH 1150 University Chemistry I	3		CH 1151
	CH 1151 University Chemistry I Lab	1		CH 1150
	CH 1153 University Chemistry I Recitation	1		CH 1150
	ENG 1101 Engineering Analysis and Problem Solving	3		MA 1031 or higher
	MA 1160 Calculus w/Technology I	4		

Semester	Course	Credits	Pre-reqs	co-req
	PH 1100 Physics by Inquiry I	1		MA 1160 or higher
	UN 1015 Composition	3		
	Essential Education: Activities for Well-Being and Success	1		
	Total	18		
2 - Spring	CH 1160 University Chemistry II	3	CH 1150 and CH 1151	
	CH 1161 University Chemistry Lab II	1		CH 1160
	ENG 1102 Engineering Modeling and Design	3	ENG 1101	MA 1160
	MA 2160 Calculus w/Tech II	4	MA 1160	
	PH 2100 University Physics I	3	MA 1160	PH 1100
	Essential Education: Foundations of the Human World	3		
	Essential Education: Activities for Well-Being and Success	1		
	Total	18		
3 - Fall	CM 2110 Material and Energy Balances	3	MA 1160, CH 1150 and CH 1151	
	CH 2410 Organic Chemistry I	3	CH 1160 and CH 1161	
	CH 2411 Organic Chemistry I Lab	1		CH 2410
	MA 3160 Multivariable Calculus w/Tech	4	MA 2160	
	PH 1200 Physics by Inquiry II	1	PH 1100	
	Essential Education: Communication Intensive = HU 3845 Human-Machine Communication	3	UN 1015	
	Essential Education: Activities for Well-Being and Success	1		
	Total	16		
4 - Spring	CM 3230 Thermodynamics	4	CM 2110, MA 2160, PH 2100	
	MA 2321 Linear Algebra	2	MA 1160	
	MA 3521 Differential Equations	2	MA 2160	MA 2321
	PH 2200 University Physics	3	PH 2100, MA 2160	PH 1200
	Tech Elective	3		
	Essential Education: Arts and Culture	3		

Semester	Course	Credits	Pre-reqs	co-req
	Total	17		
5 - Fall	CM 3110 Transport and UO I	3	CM 2110, MA 3521, MA 3160, PH 2100	
	CM 3215 ChE Fundamentals Lab	3	UN 1015	CM 3110
	CM 3240 Separations	3	CM 3230, MA 2160	
	CH 3510 Physical Chemistry I	3	CH 1160 and CH 1161, MA 2160	PH 2200
	Tech Elective = CS 1121 Introduction to Programming I	3		MA 1031 or MA 1032 or MA 1120
	Essential Education: Intercultural Competency	3		
	Total	18		
6 - Spring	CM 3120 Transport and UO II	3	CM 3110, CM 3230	
	CM 3310 Process Control	4	CM 2110, MA 3521, PH 2200	
	CM 3510 Chemical Reaction Engineering	3	CM 2110, CM 3110, CM 3230, MA 3521	
	CM 3980 Sustainable ChE	1	CM 2110, MA 3521	
	Essential Education: Experience	3		
	Essential Education: SHAPE	3		
	Total	17		
7 - Fall	CM 4110 Unit and Plant Operations I	3	CM 3120, CM 3215, CM 3240, CM 3310, CM 3510	CM 4320
	CM 4320 Process Safety	2	CM 3120, CM 3230, CM 3510	
	CM 4855 Process Analysis and Design I	3	CM 3120, CM 3215, CM 3240, CM 3510, CH 2410	CM 3980
	Tech Elective = EE2174 Digital Logic and Lab	4	CS 1121 or CS 1131 or CS 1111	
	Tech Elective	1		
	Total	13		
8 - Spring	CM 4120 Unit and Plant Operations II	3	CM 4110	
	CM 4860 Process Analysis and Design II	2	CM 4855, CM 3980	

Semester	Course	Credits	Pre-reqs	co-req
	CM 4861 Capstone Design Project	1	CM 3980	CM 4860
	CM 4315 Process Dynamics and Automation	3	CM 3310 or EE 3160	
	CM 4150 Intro to DCS HMIs	2	CM 4110	
	Free Elective	3		
	Total	14		

New Course Descriptions

CM 4315 was created to establish an undergraduate section of the existing CM 5315 course. CM 4150 was created to establish an elective based on a special topics course that has been offered multiple times. Both new courses were submitted in the Fall 2025 curriculum binder for Chemical Engineering. No new additional courses are required to launch or deliver the minor.

Course Title	cr	Description
CM 4315 Process Dynamics & Automation	3	This course provides theoretical and practical knowledge needed to design, select, evaluate, and manage today's complex control systems and advanced control strategies. On-line plant simulation software is used with actual data acquisition systems to collect and analyze data for the design of control systems.
CM 4150 Intro to DCS HMIs	2	A laboratory course focused on creating/programming graphics/control loops/alarms/sequencing for a distributed control system (DCS) and reading/creating P&IDs to help understand best practices for creating a human machine interface (HMI).

Faculty Qualifications

Two current chemical engineering faculty will support this program. Both faculty have a BS in Chemical Engineering and have PhDs in Chemical Engineering (Dr. Collins) and Agricultural & Biological Engineering (Dr. Griffin) and are considered qualified to teach the chemical engineering courses for this minor.

Name	Role	Role Detail
Jeana Collins, PhD	Faculty	Course Instruction, Assessment, Curriculum updates
Kyle Griffin, PhD	Faculty	Course Instruction

Resources Needed

Library and other learning resources needed

No library or other learning resources are needed at this time.

Suitability of existing space, facilities, and equipment

The CM 4150 Introduction to Distributed Control System Human Machine Interfaces will utilize the Chemical Engineering Department Unit Operations Laboratory. Class will take place in the

control room, and will utilize the workstations and equipment that are a part of the DeltaV Distributed Control System. This course will expand the use and capabilities of the Unit Operations Lab.

Program Costs

There are no additional costs for implementing this minor; the minor will use existing equipment/facilities that are maintained for the senior capstone laboratory sequence and process control course.