 ISSN 0737-5921, ISBN 978-1-878068-44-6

Incorporating Automation Skills into a Vacuum Technology Curriculum

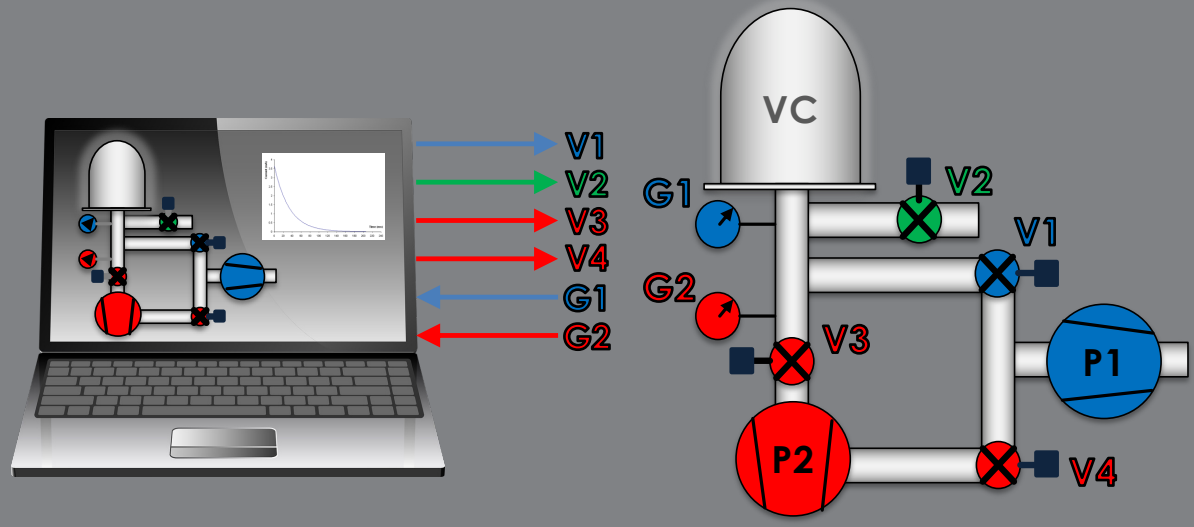
Nancy Louwagie, Thomas Johnson, John Lasswell, Normandale Community College, Bloomington, MN

Normandale Community College offers a 2-year AAS degree and certificate programs in Vacuum and Thin Film Technology for technician education. Through a series of projects funded by the National Science Foundation Advanced Technological Education (NSF-ATE) program, Normandale's Vacuum Technology faculty and staff have introduced, evaluated and adopted significant changes related to its vacuum and thin film technology program curriculum and the program's delivery modes. These changes have enhanced the program's ability to reach and engage new students. Many of these students are incumbent workers who are already working in the field using vacuum systems. In the current NSF funded project, Normandale faculty are developing a new curriculum that integrates instruction of foundational skills in automation with vacuum system operations. This curriculum will address skills development related to using documentation in support of maintenance and troubleshooting activities; setting up and testing the electrical interface between a controller, input and output (I/O) devices, and the system's pumps, gauges, valves and other instrumentation; and creating a simple human machine interface (HMI) program that automates vacuum system functions. The course learning outcomes have been reviewed by the program's advisory group participants and updated based on their feedback. This new curriculum which links automation skills with vacuum system operations is intended to support upskilling/reskilling incumbent workers.

 DOI: https://doi.org/10.14332/svc24.proc.0039

NORMANDALE
COMMUNITY COLLEGE

Incorporating Automation Skills into a Vacuum Technology Curriculum



SOCIETY OF VACUUM COATERS
TECHCON 2024

This work was made possible in part by grants from the **National Science Foundation** (ATE DUE #0603175, #1400408, #1700624, #2000454, #2202166)

Acquisition of equipment and supplies made possible in part from multiple in-kind donations and funding matches from the **Minnesota State Leveraged Equipment Program**

Introduction

- Nancy Louwagie
  - Instructor in Vacuum and Thin Film Technology at Normandale Community College (Bloomington, MN)
  - Principal Investigator, NSF-ATE DUE #2202166 “Flexible Technology Education to Upskill/Reskill for a Vacuum Technician Career”

NORMANDALE
COMMUNITY COLLEGE

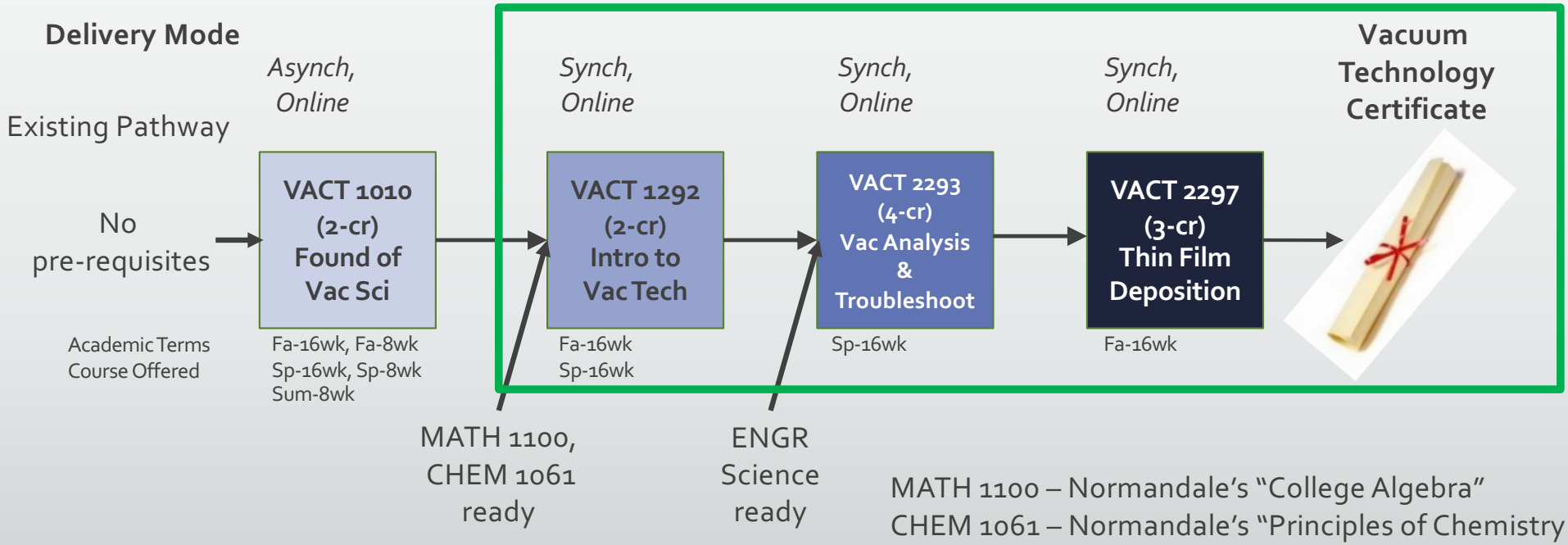
What is Normandale's Vacuum and Thin Film Technology program?

The program prepares a student to work as a technician in industries or research organizations which rely on vacuum-based processes.

Normandale offers a 2-year Associate of Applied Science (AAS) degree in Vacuum and Thin Film Technology as well as two certificates, Vacuum Maintenance Technician Certificate (28-29 credits) and/or Vacuum Technology Certificate (9-11 credits).

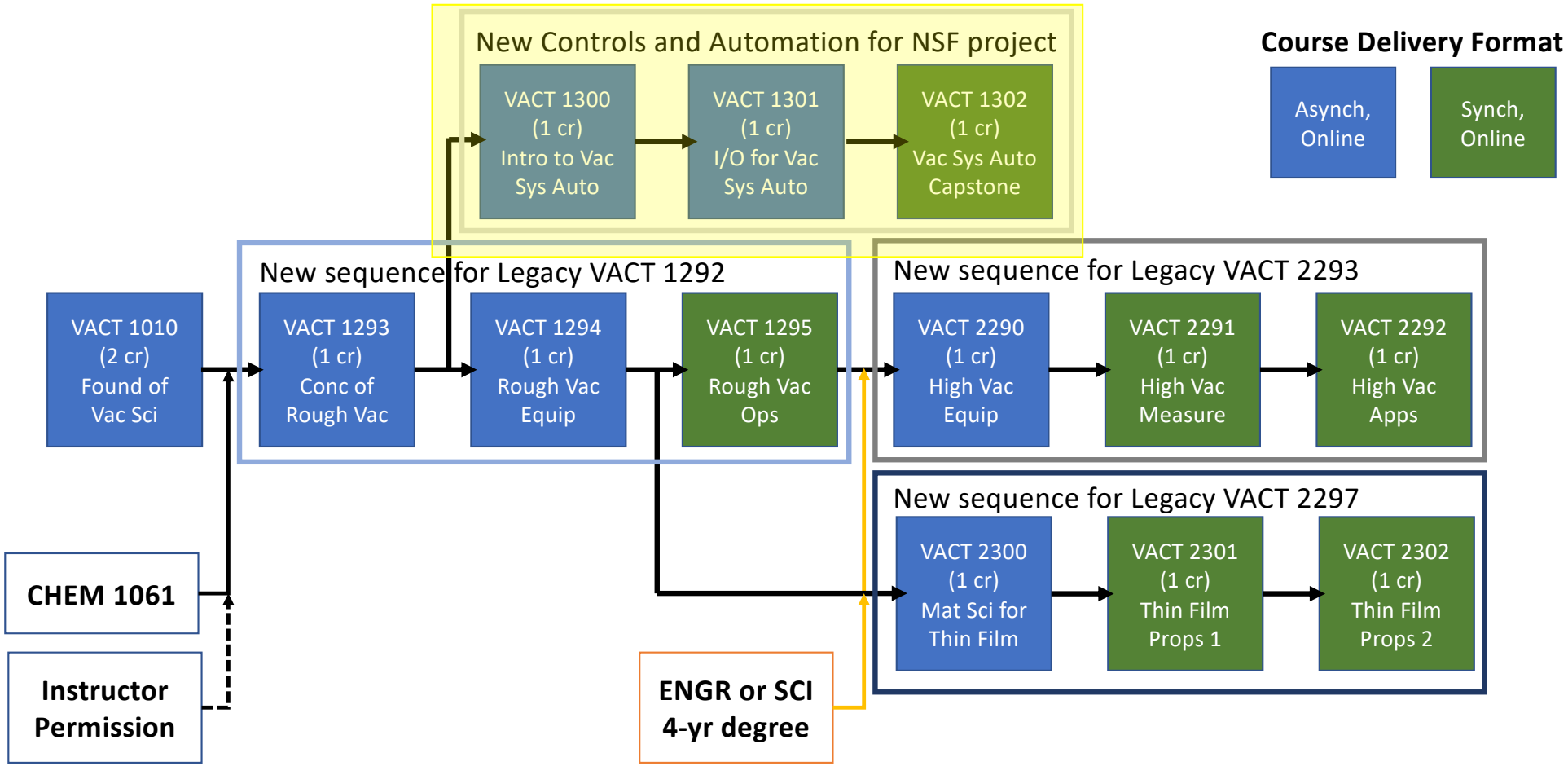
Overview of Normandale Community College's Vacuum Technology Certificate Pathway

Legacy VACT Course Pathway to Complete Certificate



MATH 1100 – Normandale's "College Algebra"
CHEM 1061 – Normandale's "Principles of Chemistry 1"

Normandale's Vacuum Technology Modularized Course Curriculum with New Automation in Vacuum Technology Option



NORMANDALE
COMMUNITY COLLEGE

Integrating the Instruction of Vacuum Systems and Automation

(1) Options for procuring functional “off-the-shelf” vacuum systems for instructional purposes are both limited and expensive. Custom Vacuum Equipment Trainer (VET) systems were designed and built to engage students in more hands-on learning using vacuum systems.

(2) Prior NSF-ATE project supported Undergraduate Research Experience (URE) activities. Students participated in developing a Human Machine Interface (HMI) for the VET systems to create a remotely operated system.

(3) The process of engaging students in the URE showed promise as a way to blend instruction of automation with the operation of vacuum systems.

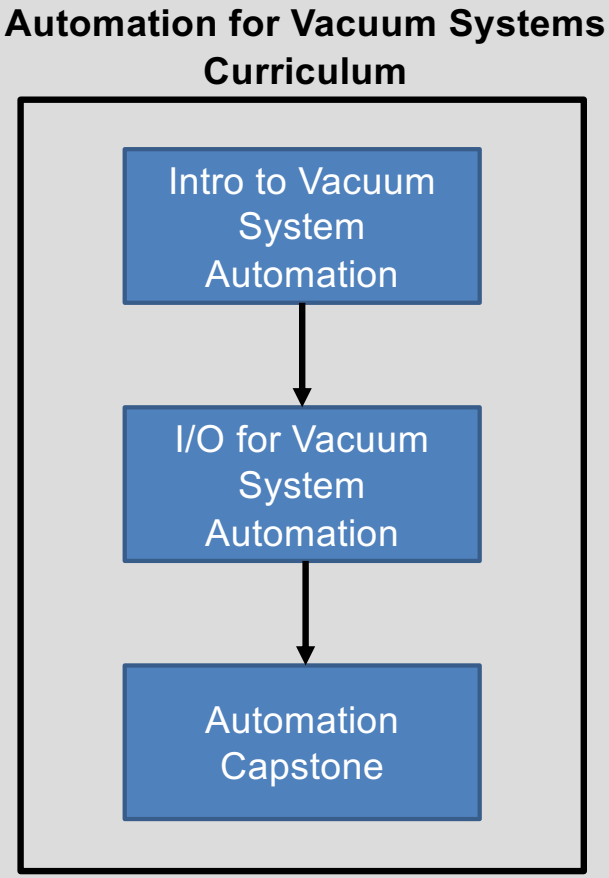
NORMANDALE COMMUNITY COLLEGE

Identifying cross-disciplinary learning opportunities

(1) Skills related to **automation**, developing and interfacing with **Human Machine Interfaces** (HMI) and **programming** are in increasing demand across manufacturing and research (CORD)

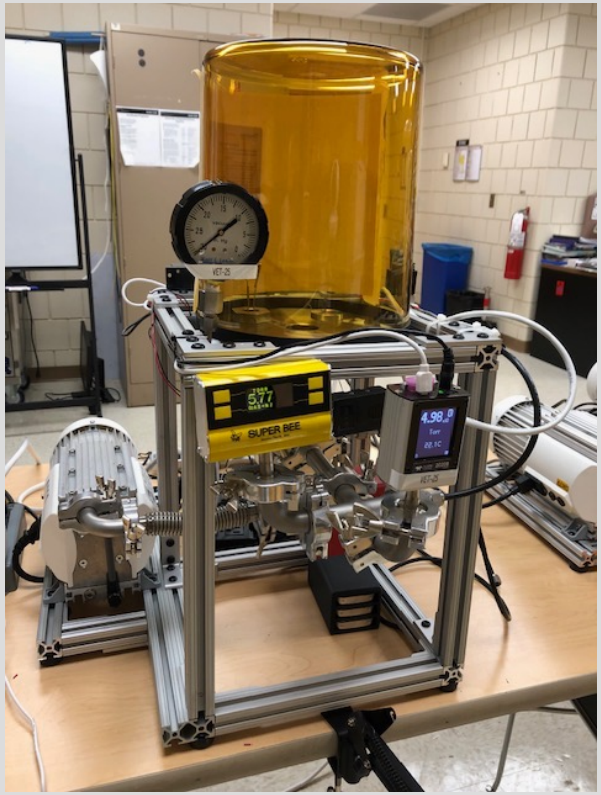
(2) A sequence of three (3), 1-credit courses is being developed and delivered that formalizes this learning as part of the Vacuum Technology curriculum.

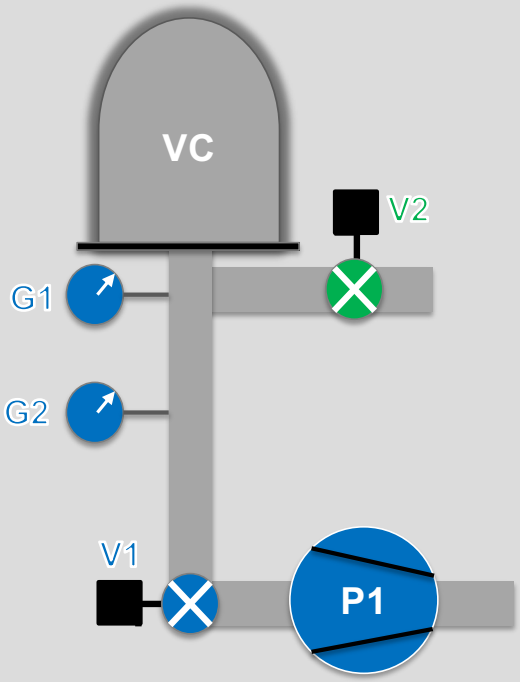
a. Introduction to Vacuum System Automation
b. I/O for Vacuum System Automation
c. Automation Capstone



NORMANDALE
COMMUNITY COLLEGE

Hands-on Learning Tool: Vacuum Equipment Trainer (VET)





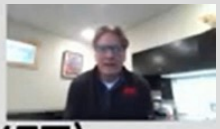
Components

- VC – Vacuum Chamber
- V1 – Roughing Valve
- P1 – Roughing Pump
- G1 – Roughing Gauge
- G2 – Roughing Gauge
- V2 – Venting Valve

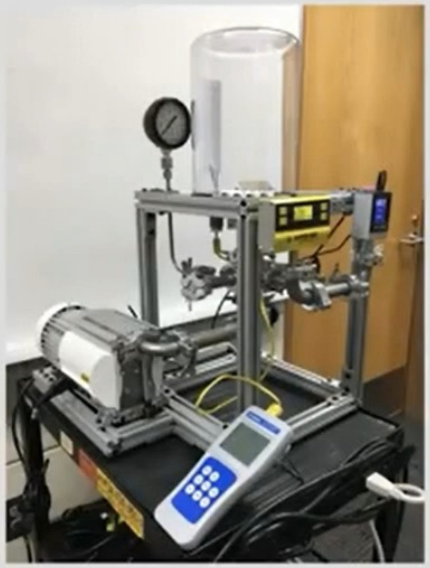
NORMANDALE
COMMUNITY COLLEGE

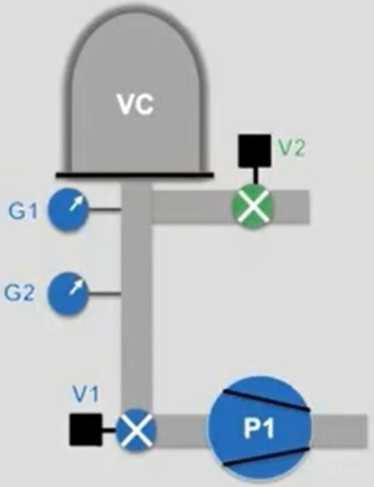
Demonstration of Remote Access VET

NORMANDALE
COMMUNITY COLLEGE



Hands-on Learning Tool: Vacuum Equipment Trainer (VET)





Components

- VC – Vacuum Chamber
- V1 – Roughing Valve
- P1 – Roughing Pump
- G1 – Roughing Gauge
- G2 – Roughing Gauge
- V2 – Venting Valve

Acknowledgements
Normandale's Vac Tech Team
(DUE #2202166 Project)

Other Team Members @ Normandale

Tom Johnson
VACT Instructor, Co-PI

Dr. Ruth Robinson,
CHEM faculty, VACT Instructor, Co-PI

John Lasswell,
VACT Instructor, Sr. Personnel

Scott Holm-Hansen,
Lab and Project Assistant

Tim Lapanne,
Advisor, Vacuum Tech 3rd Party Student Liaison Support

Team Members outside NCC

Tony Dalessio,
Co-PI; Prof of Elect Eng Technology,
SUNY Erie Community College

Bob Bailey,
External Evaluator,
Outcomes Consulting Services

This work was made possible in part by grants from the
National Science Foundation
(ATE DUE #1400408, #1700624, #2000454, #2202166)