The University Senate of Michigan Technological University

Proposal 30-18

"Minor in Manufacturing Systems"

(Voting Units: Academic)

1. **Date:** April 5, 2018

2. **Proposer Contact Information:**

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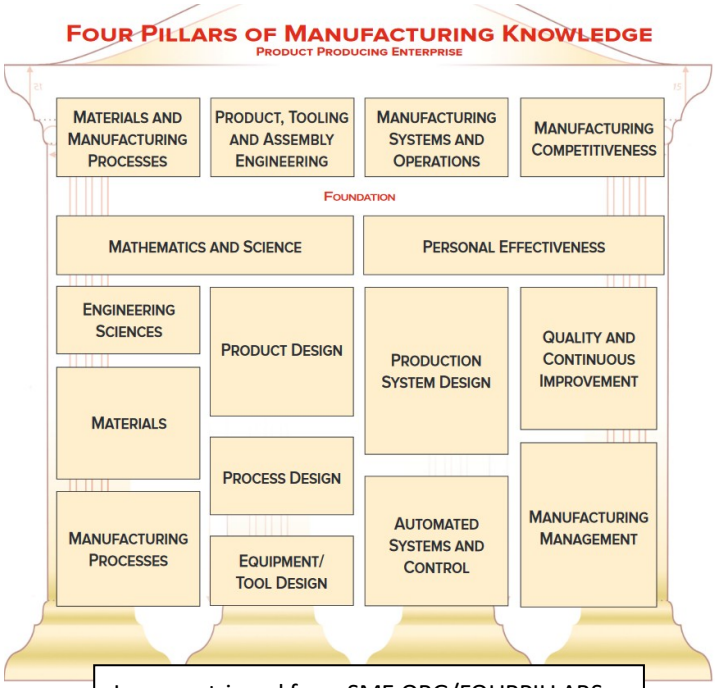
3. **Introduction:**

   The proposed Minor in Manufacturing Systems, sponsored by the Mechanical Engineering Technology program in the School of Technology, provides an opportunity for Michigan Tech students to combine courses in manufacturing fundamentals with the option to elect up to 6 credits of courses related to automating manufacturing processes.

   During the 2016-17 academic year the dean, Mechanical Engineering Technology (MET) program faculty, and the MET Industrial Advisory Board reviewed and endorsed the proposal.

4. **Rationale:**



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Products are increasingly being inventoried, picked, sorted, and delivered utilizing automated systems. This has yielded unprecedented productivity, improved quality, and better workplace safety, but insufficient innovation has taken place in educating a workforce capable of maintaining these gains. According to the Four Pillars of Manufacturing Knowledge developed by the Society of Manufacturing Engineers (SME), manufacturing practitioners require four major areas of fundamental knowledge (As shown).

Degrees in Engineering or Engineering Technology at Michigan Tech offer courses in many areas of manufacturing knowledge indicated by the Four Pillars diagram, but an option to combine courses from the Four Pillars in a Minor does not exist.

The combination of MET manufacturing related courses with Electrical Engineering Technology (EET) automation related courses will provide students the means to specialize in manufacturing with the skills necessary to integrate the electronics required to automate the processes.

5. Details of Catalog Copy:

5.1 Title of Minor

Manufacturing Systems

5.2 Catalog Description

The Manufacturing Systems Minor will provide students a broad exposure to the skills necessary for the design, set-up and troubleshooting of automated machinery for assembly, inspection and testing and/or robotic systems used to improve efficiency and safety. Skilled engineers with a background in manufacturing fundamentals such as lean, six sigma, production planning and safety along with knowledge of automated control systems used to communicate between devices are necessary for industries such as chemical processing, steel manufacturing, or power generation.

Learning Goals

Students will have the ability to:

a. Understand practical aspects of design and manufacturing as well as fundamentals of manufacturing processes.

b. Understand current concepts required to implement lean manufacturing in various manufacturing and service sectors.

c. Understand and analyze advanced manufacturing processes, both traditional and nontraditional such as additive manufacturing and computer integrated systems.

d. Apply techniques used in parametric modeling (CAD) and convert this information to all phases of production planning, machining, scheduling and quality control.

Additionally, students will have the ability to (depending on technical elective options):

a. Utilize design of simple experiments, statistical process control, lean methodologies, and corrective and preventative action to improve processes in the workplace.

b. Develop optimization concepts and safety topics necessary to design a low risk, high efficiency manufacturing facility layout.

c. Create simulation models of various industrial systems in order to analyze and experiment with characteristics of real life systems for the purpose of engineering process improvement and production design.

d. Implement the design of discreet sequential controls using programmable logic controllers (PLCs) and program PLCs using ladder logic.

e. Implement communications between a PLC and external devices.

f. Simulate the components of an industrial robotic system, safety, concepts of a work-cell system, geometry, path control, automation sensors, programming techniques, hardware, and software.

g. Utilize Allen Bradley Micro Logix, SLC500, & PLC-5 programmable controllers

h. Create and troubleshoot complex PLC programs.

5.3. List of Courses

Required Courses – 12 credits	**Prerequisites**
MET 3500 Manufacturing Processes – 3cr	(MET 1020 or ENG 1102) and (MET 1540 or MY 2100)
MET 4510 Lean Manufacturing, Principles, Concepts and Applications – 3cr	Junior or senior standing
MET 4550 Computer Aided Manufacturing – 3cr	(MET 2153 and MET 2400)
MET 4780 Advanced Manufacturing – 3cr	(MEEM 2500 or MET 3500)
Elective Courses – 6 credits (Choose 2 courses from this list)	**Prerequisites**
MET 4210 Applied Quality Techniques – 3cr	(MA 2720(C) or MA 3710(C))
MET 4355 Industrial Systems Simulation – 3cr	Junior or senior standing
MET 4585 Facilities Layout and Safety Design – 3cr	Junior or senior standing
EET 3373 Introduction to Programmable Controllers - 3cr	(EET 1411 or (EET 2120 and EET 2141) or EET 2411 or PH 2230 or EE 2110 or EE 3010)
EET 4144 Real-Time Robotics Systems – 3cr	(EET 1411 or EET 2220 or PH 2230 or EE 2110 or EE 3010)
EET 4147 Industrial Robotic Vision Systems & Advanced Teach Pendant Programming – 3cr	EET 4144
EET 4373 Advanced Programmable Controllers – 3cr	EET 3373

5.4. Prerequisites Not Listed in the Minor:
All prerequisites are listed in 5.3.

6. New Course Descriptions:

No new courses are needed.

7. Estimated Costs:

There is adequate capacity to handle an additional ten students in the majority of the core and elective courses. Enrollment beyond this number might require an additional lab section in specific courses which would be staffed with existing or additional graduate teaching assistants.

8. Planned Implementation Date: Fall 2018