THE OHIO STATE UNIVERSITY

**College of Engineering**

Undergraduate Education & Student Services

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# Memo

To: Randy Smith, Vice Provost for Academic Programs

From: Rosie Quinzon-Bonello, Assistant Dean for Curriculum and Assessment

Date: May 1, 2023

Re: Informational Items– Curriculum changes to the Bachelor of Science
in Engineering Technology (BSET) Program

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On April 28, 2023, the College of Engineering Committee for Academic Affairs voted unanimously to approve the attached proposal to revise the BSET program curriculum:

Pgs 2-3

- Change of title for ENGRTEC 4500 from *Industrial Robotics* to *Intelligent Manufacturing and Automation*

- Remove BUSOBA 4250 *Six Sigma Principles* and replace with ENGRTEC 4250 *Lean Six Sigma Foundations*

Pgs 4-8

- Request that the certificate that was approved April 2021 as a 1b certificate (embedded) be changed to a 1a certificate (stand-alone) so it can be awarded separately from a degree.

- Add MATH 1152, 1155, or 1172 as additional requirements to the certificate, which would accommodate students coming in with different Math.

Yours sincerely,

Rosie Quinzon-Bonello

April 6, 2023

TO:  CCAA Committee

RE:  Curriculum change proposal for the BS Degree In Engineering Technology, College of Engineering

The CDAC Curriculum Committee for the BS Degree In Engineering Technology has approved and would like to propose the following program changes:

1) Title change for ENGRTEC 4500 to Intelligent Manufacturing and Automation.
    a. Rationale:  To better represent the course objectives

2) Request that ENGRTEC 4250 Lean Six Sigma Foundations course replace the BUSOBA 4250 Six Sigma Principles course.
    a. Rationale:  To align the course objectives to better teach engineering technology students in an experiential learning manner with "real world" Lean Six Sigma projects.

Sincerely,

Sandra Furterer

Professor of Practice
Lead Faculty for BS Engineering Technology Program

# Bachelor of Science
# Engineering Technology

*Students in this major will complete a minimum of 120.5 hours outlined as follows.*

## General Education Requirements

| Requirement | Course Options | Hours |
|---|---|---|
| GE Launch Seminar | ACADAFF 1201 | 1 |
| Foundations: Writing and Information Literacy [a] | *Student Choice* | 3 |
| Foundations: Mathematical & Quantitative Reasoning/Data Analysis [a] | *Student Choice\** | 0-5 |
| Foundations: Literary, Visual and Performing Arts- Prefer ENGR 1300s [a] | *Student Choice* | 3 |
| Foundations: Historical & Cultural Studies [a] | *Student Choice* | 3 |
| Foundations: Natural Science [a] | *Student Choice\** | 0-5 |
| Foundations: Social & Behavioral Sciences [a] | *Student Choice* | 3 |
| Foundations: Race, Ethnic and Gender Diversity [a] | *Student Choice* | 3 |
| Theme: Citizenship for a Diverse & Just World [b] | *Student Choice* | 4 |
| Theme: Student Choice [b] | *Student Choice* | 4 |
| GE Reflection | ACADAFF xxxx | 1 |
| **Total** | | **25-35** |

## College / Degree Requirements [a, b]

| Requirement | Course Options | Hours |
|---|---|---|
| MATH 1154/1155, (Math & Quantitative Reasoning / Data Analysis) | | 8 |
| PHYSICS 1250\* (Nat Sci) | | 5 |
| ENGR 1181.0x, 1182.0x | | 4 |
| ENGR or EXP 1100.01 | | 1 |
| **Total** | | **18** |

[a] Some coursework required by the major or college may satisfy GE requirements. Please add an asterisk to "student choice" for any GE category where that category can be satisfied by a required course. Please indicate in parentheses following the course listing within College/Degree requirements or Major Coursework what GE category the course satisfies ( e.g., "Biology 1113 (Nat Sci)" in the Major Core for programs that require this as a prerequisite to major coursework). There is no limit to the number of courses that may overlap between the GE Foundations and the rest of the academic program

[b] Students complete either a 4-credit course or two 3-credit courses in each of two General Education Theme areas: Citizenship for a Diverse & Just World (required), and the student's choice of available GE Themes. If major-required courses are approved as a GE Theme course, one course in each GE Theme area may double count in the GE and major hours. Theme courses are identified with a ❖ symbol.

**\*** These courses are can also fulfill certain GE Requirements above (may be degree requirements, pre- or co-requisites, or major courses).

## Major Coursework [a, b]

| Course | Title | Hours |
|---|---|---|
| **Major Core** | | |
| ENGRTEC 1200 | Introduction to Engineering Technolgy | 1 |
| ENGRTEC 1500 | Manufacturing Processes 1 | 3 |
| ENGRTEC 1600 | Engineering Graphics | 3 |
| ENGRTEC 2100 | Introduction to Robotics with Vision | 2 |
| ENGRTEC 2300 | Electric Circuits | 3 |
| ENGRTEC 2500 | Manufacturing Processes 2 | 2 |
| ENGRTEC 3100 | Materials Science with Engineering Technology Applications | 0.5 |
| ENGRTEC 3600 | Technology Structures and Applications for Controls | 3 |
| ENGRTEC 3700 | Mechanical Processes | 3 |
| ENGRTEC 3800 | Project Management for Engineering Technology | 3 |
| ENGRTEC 3900 | Controls PLC1 | 3 |
| ENGRTEC 4200 | Industrial Automation - Controls PLC2 | 3 |
| ENGRTEC 4250 | Lean Six Sigma Foundations | 3 |
| ENGRTEC 4300 | Facility Layout and Integration | 3 |
| ENGRTEC 4400 | Leadership and Management change | 3 |
| ENGRTEC 4500 | Intelligent Manufacturing and Automation | 3 |
| ENGRTEC 4600 | Power and Drives | 3 |
| ENGRTEC 4700 | Networks, Security, & Safety Applications | 3 |
| ENGRTEC 4900 | ENGRTEC Capstone 1 | 3 |
| ENGRTEC 4910 | ENGRTEC Capstone 2 | 3 |
| | **Total** | **53.5** |
| **Required Non-Major General Courses** | | |
| CSE 2111\* | Modeling and Problem Solving with Spreadsheets and Databases | 3 |
| ISE 2040 | Engineering Economics | 2 |
| STATS 3440 | Statistics in Quality | 3 |
| CSE 1222 | Introduction to Computer Programming in C++ for Engineers and Scientists | 3 |
| MATSCEN 2010 | Introduction to Engineering Materials | 3 |
| BUSOBA 3230 | Introduction to Operations Management: Improving Competetiveness in Organizations | 3 |
| | Removed BUSOBA 4250 (3) | |
| PHYSICS 1231 | Physics for Enginering Technology: Electricity and Magnetism | 3 |
| CHEM 1250 | General Chemistry for Engineers | 4 |
| | **Total** | **24** |
| **Required Technical / Directed / Targeted Electives; Career Courses** | | |
| Technical Electives | **Total** | 0 |

| | |
|---|---|
| General Education | 25-35 |
| College / Degree | 18 |
| Major Core | 53.5 |
| Required Non-Major General | 24 |
| Technical / Directed / Targeted Electives; Career Courses | 0 |
| **Minimum Total Credit Hours for Degree** | **120.5** |

Degree requirements and course offerings are subject to change. Last updated on: pending
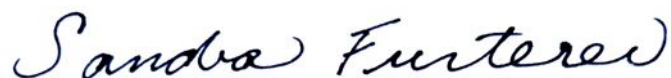
April 13, 2023

TO:  CCAA Committee

RE:  Curriculum change proposal for the BS Degree In Engineering Technology, College of Engineering

The CDAC Curriculum Committee for the BS Degree In Engineering Technology has approved and would like to propose the following program change:

1) We would like to request that the certificate that was approved April 2021 as a 1b certificate (embedded) be changed to a 1a certificate (stand-alone) so it can be awarded separately from a degree.
   a. Rationale:  In discussions with how best to process this certificate for the students, the Registrar's Office suggested that we make this request so it can be awarded separately from a degree.

2) We would like to add/change the following Math courses to the certificate: MATH 1151, 1152, 1154, 1172, 1155, or a higher level math course utilizing 1152, 1172, 1155 as a prerequisite
   a. Rationale:  The students potentially take these additional math courses for their Calculus credit. Note that 1151 and 1154 were already included in the certificate

Sincerely,

*Sandra Furterer*

Professor of Practice
Lead Faculty for BS Engineering Technology Program

# Manufacturing Foundations Certificate
The Ohio State University

**Revised: 4/13/2023**

**Program Description:** **The Bachelor of Science in Engineering Technology (BSET)** Manufacturing Foundation Certificate at The Ohio State University derives from a statewide program that prepares students for careers in the high-demand field of manufacturing. Endorsed by the Ohio Engineering Technology Educators Association and approved by the Ohio Department of Higher Education, the Manufacturing Foundations Certificate is composed of a series of courses that give students a broad foundation in quality systems, applied math and writing, product design, fundamentals of materials, and teamwork in a manufacturing environment. This certificate is categorized as a 1a Stand Alone certificate , according to the description outlined by the Office of Academic Affairs.

**Prerequisite:** College ready with minimum requirements met for entry into the BSET program at the regional campuses.

**Program Goals/Outcomes:** The certificate curriculum prepares students for careers in industry and it is also effective preparation for continued engineering education. Upon completion of the program, students will be able to:

1. Apply knowledge related to industry-led technical electives in subjects such as Engineering Materials, Quality Control, Internet of Things, Industry 4.0, and Safety.
2. Use a commercially available CAD system to create meaningful engineering drawings including: dimensions and tolerances; multiple views and projections; assemblies and bill of materials; and 3D models.
3. Apply their knowledge of materials to manufacturing processes and demonstrate an understanding of processes such as material removal, forging, casting, forming, finishing; fabrication processes such as welding, adhesives, and fasteners; production efficiencies (e.g., speed and feeds); and safety procedures and methods.
4. Work as a member of a team to communicate effectively, solve problems, and improve productivity.
5. Continue their education seamlessly toward a bachelor's degree and beyond.

## Implementation at BSET —the Proposed Curriculum

This proposed Manufacturing Foundation Certificate program meets the requirements of the statewide model.
The proposed curriculum is:

| | |
|---|---|
| ENGLISH 1110.xx | 3 |
| MATH 1151, 1152, 1154, 1172, 1155, or a higher level math course utilizing 1152, 1172, 1155 as a prerequisite | 4/5 |
| ENGRTEC 1200 Intro to Eng Tech | 1 |
| ENGRTEC 1500 Mfg Processes 1 | 3 |
| ENGRTEC 1600 ENGR Graphics | 3 |

| ENGRTEC 2500 Mfg Processes 2 | 2 |
|---|---|
| Total Credit Hours | 16-17 |

Most or all credits earned in this certificate apply seamlessly toward the Bachelor of Science in Engineering Technology degree.

**Beyond this Program:**  This Manufacturing Foundation Certificate gives students the ability make progress toward the Bachelor of Science in Engineering Technology Ohio State. At the same time, adding this certificate signifies to employers considering students for internships and other employment opportunities that they are "work ready." Upon completion of the stand-alone certificate, the student will receive a Program Level Certificate that they can provide to their employers. Additional industry-recognized certificates that provide value-add to the BSET program will be reviewed and submitted for approval as they become available. Those certificate programs may be embedded in courses such as ENGRTEC 4200 Industrial Automation/PLC 2; ENGRTEC 3600 Technology Applications ; and ENGRTEC 4150 Capstone 2, and ENGRTEC 4250 Lean Six Sigma Foundations with Lean Six Sigma Green Belt.

**Projected enrollment:**  There is considerable emphasis being placed on recruiting more young people into the manufacturing field. For example, the Ohio Manufacturers' Association (OMA) received US Department of Labor and state funding to support manufacturing pathways career programs. Other colleges and universities across Ohiowith engineering technology degree programs, including Miami University,  have approved or are currently requesting approval for the Manufacturing Foundations Certificate.

Conservatively, with promotion of the pathways and partnering with local industry, we can attract additional students per year into this pathway. We expect these students continue toward the BSET degree as they complete the certificate program.

**Staffing:**  There is currently room in the program to support the additional students at the regional campuses. We may need additional sections of technical courses staffed by adjunct faculty in the future.

**Program Implementation:** The BSET faculty have begun partnering with local industries to support the BSET program as well as recruit and identify a cohort of students. Beginning with ENGRTEC 1200, students work with industry partners to learn more about the types of careers engineering technology graduates can pursue. This includes exposure to various manufacturing processes and learning more about company policies and procedures to prepare the student for full-time work once they complete the BSET academic coursework. Some students will complete the academic courses required for the Manufacturing Foundations Certificate in two semesters. Upon completion of the academic courses, which include industry mentorship, assignments and work skills observation and development, the student is eligible to receive the Manufacturing Foundations Certificate. Course advisers, career services, faculty and associate deans at the regional campuses have indicated that they will assist and support this program.

**Manufacturing Foundations Curriculum (17-18 semester credit hours)**

| Transfer Assurance Guide/Transfer Module Course | Course Description |
|---|---|
| A course in Technical Writing -OR- ENGLISH 1100: First-Year English Composition (3 semester credit hours) | Written communication is important to success in business and industry. Students are encouraged to develop effective writing skills.<br><br>Practice in the fundamentals of expository writing, as illustrated in the student's own writing and in the essays of professional writers. |
| MATH 1154: Calculus 1 for Engineering Technology (4 semester credit hours) -OR- MATH 1151: Calculus 1 (5 semester credit hours) | Calculus 1 for Engineering Technology (MATH 1154): Course designed to be the first in a two-course calculus sequence specifically designed for Engineering Technology. It covers the standard calculus topics, including limits, differentiation, integration, optimization, and approximation with an emphasis on building mathematical intuition, problem solving ability and using appropriate technology to find solutions. The skills learned from this class are closely integrated with the topics of Physics 1250 and are intended to be a solid foundation in calculus applications for further courses in Engineering Technology.<br><br>OR<br><br>Calculus 1 (MATH 1151): To master the essentials of Differential Calculus and its applications, to develop the computational and problem -olving skills for that purpose, and to introduce the students to Integral Calculus. Learning Objectives: To understand the basic techniques of Calculus, including the notions of limit and continuity, the definition of the derivative of a function, how to compute the derivative of any elementary function (polynomial, exponential, logarithmic, trigonometric, or any combination of such), how to determine maxima and minima, and how these techniques apply to real-life situations; the definition and some applications of definite integrals, Fundamental Theorem of Calculus and Substitution Rule.<br><br>OR<br><br>Calculus 2 (MATH 1152): Integral calculus, sequences and series, parametric curves, polar coordinates, (optional: vectors).<br><br>OR<br><br>Calculus 2 (MATH 1155): Calculus II for Engineering Technology is the second in a two-course calculus sequence specifically for Engineering Technology. It covers standard Calculus topics including related rates, Taylor Polynomial approximations, differential equations and functions of several variables with an emphasis on building mathematical intuition, problem solving and using appropriate technology to find solutions.<br><br>OR<br><br>Engineering Mathematics A (MATH 1172): Techniques of integration, Taylor series, differential calculus of several variables. Applications. |

| | |
|---|---|
| ENGRTEC 1600: Graphics for Engineering Technology 3 semester credit hours | Designed to help students gain experience creating and interpreting 2D Computer-Aided Drawings in AutoCAD. Additionally, this course will explore various forms of technical graphics used in the field of Engineering Technology including facility layouts, piping and instrumentation diagrams, and electrical schematics. Coursework will emphasize utilizing technical graphics to solve Engineering Technology problems. Students will understand the use, need for, and range of technical drawings and documentation provided on existing equipment; the use, need for, and range of technical drawings and documentation provided on existing equipment; and a wide range of technical diagrams, drawings and models (i.e. Piping & Instrumentation Diagrams (P&ID), electrical control drawings, HVAC drawings, and facility layouts) |
| ENGRTEC 1500: Manufacturing Processes 1 3 semester credit hours | Covers the history of manufacturing, tools and machines, and operations of machine shop equipment. Students will learn the basic functions of machine shop equipment (lathe, mill, drill press, shear, band saw, grinder) and equipment selection to perform an operation. Students to describe the key safety risks associated with using basic machine shop equipment. Along the way, this course will give students a good opportunity to function individually and on teams and communicate effectively learn to work in groups to accomplish a task. |
| ENGRTEC 2500: Manufacturing Processes 2 3 semester credit hours | Course is designed to help students become familiar with modern manufacturing processes as well as design, create, and assemble material structures/objects by combining manufacturing and drafting knowledge. Students to apply knowledge, techniques, skills and modern tools of mathematics, science, engineering, and technology to solve broadly defined engineering problem appropriate to the discipline. Students to apply written, oral, and graphical communication in broadly defined technical and non-technical environments; and an ability to identify and use appropriate technical literature |
| ENGRTEC 1200: Introduction to Engineering Technology 1 semester credit hour | Introduction to the roles available in engineering technology, professional development planning for students pursuing this degree, and exposure to common elements in engineering technology. Course work will emphasize written and verbal communication skills. Introduces Engineering Technology students to resources and skills that will help them to be successful in their studies and ultimately in their careers. |
| ENGR 4191 Professional Practice in Engineering 1-2 semester credit hours | Students engaged in a paid internship or similar work-based learning experience (OPTIONAL – not required for the certificate) |
| 17-18 credit hours total | |