KENT STATE UNIVERSITY
CERTIFICATION OF CURRICULUM PROPOSAL

Preparation Date **24-Oct-17** Curriculum Bulletin _____

Effective Date **Fall 2018** Approved by EPC _____

Department	**Applied Engineering**
College	**AR - Aeronautics and Engineering**
Degree	**BS - Bachelor of Science**
Program Name	**Mechatronics Engineering** Program Banner Code
Concentration(s)	Concentration(s) Banner Code(s)
Proposal	**Establish program**

Description of proposal:

The College of Aeronautics and Engineering is requesting approval to offer a Bachelor of Science in Mechatronics Engineering. This program was developed as a complement to the existing mechatronics (engineering technology) program. The mechatronics engineering curriculum includes high level math, theory and conceptual design, whereas the engineering technology program is more hands-on and application oriented giving students two pathways to choose from. There are only three ABET-acredited mechatronics engineering programs in the country and with an aging workforce and a shortage of skilled employees in the areas of advanced/automated manufacturing, this program will provide graduates with skills and knowledge indutry is seeking.

Does proposed revision change program's total credit hours? ☐ Yes ☐ No

Current total credit hours: Proposed total credit hours **120**

Describe impact on other programs, policies or procedures (e.g., duplication issues; enrollment and staffing considerations; need; audience; prerequisites; teacher education licensure):

There will be no impact on or duplication with other programs. Additional staff may be necessary.

Units consulted (other departments, programs or campuses affected by this proposal):

Kent State Tusc campus

REQUIRED ENDORSEMENTS

Jackie Bulles 10/24/17

Department Chair / School Director

_____ ___/___/___

Campus Dean (for Regional Campuses proposals)

Robert G Sinos Jr 10/26/2017

College Dean (or designee)

_____ ___/___/___

Dean of Graduate Studies (for graduate proposals)

_____ ___/___/___

Senior Vice President for Academic Affairs and Provost (or designee)

HIGHER LEARNING COMMISSION

FORM

New Programs

Substantive Change Application

Institution: Kent State University City, State: Kent, Ohio

Name of person completing this application: Therese E. Tillett

Title: Executive Director, Curriculum Services Phone: 330-672-8558 Email: ttillet1@kent.edu

Date Submitted:

The questions are designed to elicit brief, succinct, detailed information, rather than a narrative or references to extensive supporting documents. Do not attach other documents unless they are specifically requested in the questions and are germane to the request. The total submission should be no more than 10–12 pages on a single classification of change. (The page limit excludes attachments. However, the overall length, including attachments, should not exceed 200 pages.)

If the person completing this application is not the CEO, CAO or the ALO of the institution, it is understood that the person completing and submitting this application has consulted with and informed those individuals.

Please note: HLC plans to update the change forms annually, on or about September 1 of each year. However, if a change application form was accessed more than 90 days prior to filing, it is recommended that the institution visit http://www.hlcommission.org/change to ensure that there have been no changes to the application form in the intervening time.

Submit the completed application as a single PDF file on the following webpage: http://www.hlcommission.org/document_upload/.

Part 1: General Questions

1. **Requested Change(s).** Concisely describe the change for which the institution is seeking approval.

   Kent State University proposes to offer a Bachelor of Science degree in Mechatronics Engineering to be offered through the university's College of Aeronautics and Engineering.

   Mechatronics engineering focuses on the application of the basic engineering principles of mechanical, electrical, computer and control systems; the field revolves around the design, construction and operation of automated systems, robots and intelligent products, which result from the integration of software and hardware.

2. **Is this application being submitted in conjunction with another application?**

☐ Yes

☒ No

3. **Classification of Change Request.**
Note: not every institutional change requires prior review and approval. Review the "Overview of HLC Policies and Procedures for Institutional Changes Requiring HLC Notification or Approval" to make certain that current HLC policy requires the institution to seek approval.

New academic program(s):

☐ Certificate ☒ Bachelor's ☐ Diploma ☐ Master's/specialist

☐ Associate's ☐ Doctorate ☐ *Check if program is at a new degree level*

An institution submitting more than one change request should complete multiple applications, one for each type of change. The types of change requests include:

- Change in mission
- Change in student body
- Competency-based education (credit-based; direct assessment; hybrid) programs
- Consortial arrangement
- Contractual arrangement
- Substantially changing the clock or credit hours required for a program
- Change in academic calendar (e.g., quarters to semester) or change in credit allocation
- Teach-out plan if closing location provides total degree programs
- Distance or correspondence education
- New programs
- Certificate programs
- Branch campuses and additional locations

4. **Special conditions.** Indicate whether any of the conditions identified below fit the institution (Yes or No). If Yes, explain the situation in the space provided.

a) Is the institution, in its relations with other regional, specialized, or national accrediting agencies, currently under or recommended for a negative status or action (e.g., withdrawal, probation, sanction, warning, show-cause, etc.)?

No.

b) Is the institution now undergoing or facing substantial monitoring, special review, or financial restrictions from the U.S. Deptartment of Education or other federal or state government agencies?

No.

c) Has the institution's senior leadership or board membership experienced substantial resignations or removals in the past year?

No.

d) Is the institution experiencing financial difficulty through such conditions as a currently declared state of exigency, a deficit of 10% or more, a default or failure to make payroll during the past year, or consecutive deficits in the two most recent years?

No.

e) Is the institution experiencing other pressures that might affect its ability to carry out the proposal (e.g., a collective bargaining dispute or a significant lawsuit)?

No.

5. **Approvals.** Mark whether each type of approval is required prior to implementing the proposed change. If "Yes," attach documentation of the approval to the request. If "No," attach evidence that approval is not needed.

Internal (faculty, board) approvals	☒ Yes	☐ No	
System approvals	☐ Yes	☐ No	☒ Not Applicable
State approval	☒ Yes	☐ No	
Foreign country(ies) approvals	☐ Yes	☐ No	☒ Not Applicable
For Distance or Correspondence Education only: Process in place to ascertain and secure state approval(s) as required	☐ Yes	☐ No	

6. **Specialized Accreditation.** Complete this section only if specialized accreditation is required for licensure or practice in program(s) covered by this change application.

☐ The institution has already obtained the appropriate specialized accreditation. Attach a copy of the letter from the agency granting accreditation.

☐ The institution has begun the process of seeking or plans to seek specialized accreditation. Specify the name of the agency and the timeline for completing the process in the space below. (If approval is a multi-stage process, the institution should contact the HLC staff liaison to discuss the timeline before submitting this change application form.)

☐ The institution does not plan to seek specialized accreditation. Provide a rationale for not seeking this accreditation in the space below.

7. **Changes Requiring Visits.** This section is not for HLC-mandated visits such as additional location confirmation visits or campus evaluation visits.

Note: Complete this section only if the institution is already aware that the proposed change will need to be reviewed through a visit. The institution may submit Part 1 of the change request application to begin the process of scheduling a Change Visit or adding the proposed change to an already scheduled visit. The full application must be submitted at a later date. (If the institution is unsure whether a visit is required, leave this section blank and submit the full change application. HLC will advise the institution based on the information provided.)

a) Select the type of visit the institution is requesting:

☐ Request to schedule a Change Visit.

Change Visits typically are scheduled approximately four months from the date an institution submits its change request. The full change application and other required materials will be due to HLC and the peer review team eight weeks before the visit date. See http://www.hlcommission.org/change-visit for more information.

☐ Request to add a proposed change to an already scheduled visit. **Note:** Such requests must be submitted at least six months before the visit date.

Specify type of visit and date scheduled:

The institution's full change application should be submitted along with other materials required for the visit.

b) Provide URLs to the institution's Faculty/Staff Handbook and Catalog below. If the URLs are not available, please provide PDF versions of these documents when submitting other required materials prior to the visit.

Faculty/Staff Handbook URL:

Catalog URL:

Part 2: Topic-Specific Questions

An institution should submit a separate application for each requested program (unless the programs represent closely related disciplines). If more than one program is being requested in this application, please be sure to sufficiently address each program when answering the following questions, particularly in Sections A, D, E and F. Each proposed new program should be identified by using the *Classification of Instructional Programs* terminology (CIP codes). CIP codes are established by the U.S. Department of Education's National Center for Education Statistics as a taxonomic scheme that supports the accurate tracking and reporting of fields of study and program completions activity. More information is available at http://nces.ed.gov/ipeds/cipcode/.

Attach the "Substantive Change Application, Part 1: General Questions" as page one of your application. That completed form and your answers to the questions below will constitute your request for approval of a substantive change. This form will be the basis for review of this application.

Section A. Characteristics of the Change Requested

1. Identify the basic characteristics of the proposed educational program as indicated below:

a) The full name of the proposed program, the specific degree (if applicable) or the instructional level (if not a degree program), and the six-digit CIP code XX.XXXX of the program (CIP codes, program name, and additional description [optional])

The name of the program will be the Mechatronics Engineering major within the Bachelor of Science degree. The CIP most aligned with the program's outcomes is the following:

14.4201 Mechatronics, Robotics, and Automation Engineering. A program that prepares individuals to apply mathematical and scientific principles to the design, development and operational evaluation of computer controlled electro-mechanical systems and products with

embedded electronics, sensors, and actuators; and which includes, but is not limited to, automata, robots and automation systems. Includes instruction in mechanical engineering, electronic and electrical engineering, computer and software engineering, and control engineering.

b) Total credit hours (indicate whether semester or quarter) for completion of the program

The Mechatronics Engineering major is 121 semester credit hours, comprising 65 credit hours of major coursework and 56 credit hours of mathematics, physics and general education coursework.

c) Normal or typical length of time for students to complete the program

Full-time new students will be able to complete the program in four years (eight semesters).

d) Proposed initial date for implementation of the program

Fall 2018 Semester.

e) Primary target audience for the program (e.g., full-time, part-time, traditional college age, working adults, transfer students, military personnel, or particular ethnic group)

The target audience for the Mechatronics Engineering major is full-time, traditional students.

f) Projected life of the program (single cohort or ongoing)

The program will have ongoing admission.

g) Whether the program will be part of contractual or consortial arrangement

Not applicable.

2. Identify if the institution is requesting new stipulations for the proposed program and provide a rationale for this request.

Not applicable.

3. If the institution is planning any involvement by external organizations (other than accredited higher education institutions) in key operations as identified below, provide the information requested below and complete the Contractual Screening Form for each planned involvement. (Note that such involvement by a parent company or by one of its subsidiaries external to the institution in any of these operations should be reported.) If the screening form indicates contractual approval is required, complete the full contractual application and submit it in conjunction with the program application. If the screening form indicates no further action is required, attach the confirmation email from HLC.

Type of Involvement	Name(s) of External Organization(s)	Percent of Involvement
A. Recruitment and admission of students	Not applicable	Not applicable
B. Course placement and advising of students	Not applicable	Not applicable
C. Design and oversight of curriculum	Not applicable	Not applicable
D. Direct instruction and oversight	Not applicable	Not applicable
E. Other support for delivery of instruction	Not applicable	Not applicable

Section B. Institution's History With Programs

4. Does the institution currently offer a program at the same instructional level and with the same 4-digit CIP code (XX.XX) as the proposed program? If so, identify the program currently offered and whether it is a degree program. Will the proposed program replace the program currently offered?

   Presently, Kent State does not offer a bachelor's degree major in the same four-digit CIP series (14.42 Mechatronics, Robotics and Automation Engineering.).

5. Does the institution currently offer two or more programs at the same instructional level with the same 2-digit CIP code (XX.) as the proposed program? If so, identify the two such programs with the highest numbers of graduates during the past year, along with their numbers of graduates.

   Kent State offers two bachelor's degree major with the same two-digit series (14 Engineering).

   - Applied Engineering major: 46 graduates in fiscal year 2017
   - Aerospace Engineering major: first cohort of 28 students entered in fall semester 2017

Section C. Institutional Planning for Program Change

6. What impact might the proposed program have on challenges identified as part of or subsequent to the last HLC review and how has the institution addressed the challenges?

   There are no identified challenges.

7. Briefly describe the planning process for determining the need for this new program, including the role of faculty in the planning and approval process.

   Faculty and administrators from Kent State's College of Aeronautics and Engineering engaged in discussions with industry partners and reviewed internship and job opportunities while developing the program. These actions indicated that a mechatronics engineering program would provide the skills and knowledge needed by prospective employees to be qualified to replace an aging workforce in traditional jobs, as well as fill positions in an evolving industry. Faculty stay on top of industry trends, and they believe that a mechatronics engineering program will complement existing Kent State programs, and that graduates of the program will be highly pursued by industry.

   [Future Actions] In addition to be approved by the applied engineering faculty, the proposal was approved by the faculty-led Aeronautics and Engineering Curriculum Committee, the Educational Policies Council, a subcommittee of the Faculty Senate; and the Faculty Senate.

8. What are the physical facilities and equipment needed to support the program? Indicate the impact that the proposed change will have on the physical resources and laboratories that currently accommodate existing programs and services, or identify new laboratory and preceptor needs.

   Existing facilities on the Kent Campus will be adequate for the implementation of the degree program. As enrollment increases, additional laboratory space will be needed. In 2015, a new, 55,000-square-foot aeronautics and technology building opened on the Kent Campus.

   The building houses classrooms and laboratories to support the College of Aeronautics and Engineering programs, including an advanced mechatronics laboratory, a magnethermic casting laboratory and an air traffic control simulation laboratory.

9. What is the evidence that a market for the new program(s) exists? How has estimated program demand been factored into realistic enrollment projections? How has this evidence been used in planning and budgeting processes to develop a quality program that can be sustained?

Mechatronics is an emerging field that first found its place in automation vendors, major consumer packaged goods manufacturers, and packaging machine builders. However, more and more companies are employing the mechatronics approach to design, especially with the growth of computing power, which makes applying mechatronics easier than ever before.

The Ohio Governor's Office of Workforce Transformation presented a report entitled "Building Ohio's Future Workforce." An excerpt taken from the report is as follows:

> "In a 2016 McKinsey & Company study of more than 800 occupations, the continued growth of automation will drive substantial workforce changes over the next decade. Automation will likely result in very few occupations being eliminated entirely; however, it also likely will affect a portion of almost all jobs, in varying degrees. The McKinsey study attests that technologies available today could automate 45 percent of the activities that people are paid to perform and that about 60 percent of all occupations could see 30 percent or more of their component activities automated." [1]

A recent Gallup study found that "approximately 2.7 million jobs (22 percent of existing workforce) will be retiring from the manufacturing workforce between now and 2025. The U.S. manufacturing industry will add nearly 3.4 million jobs in the next decade to meet both future domestic and international demand. Moreover, as manufacturing firms expand their operations over this 10-year period, they will need an additional 700,000 workers to meet the demand."[2]

According to the Ohio Manufacturers' Association, the Ohio manufacturing sector was fourth in the nation and has 5.6 percent of manufacturing jobs in the United States.[3] Using 2.7 million jobs as the base, this means Ohio must replace approximately 151,000 workers. While not all these jobs will be in mechatronics, even one percent would correspond to a demand for 1,500 new employees with mechatronics credentials.

[1] Ohio Governor's Office of Workforce Transformation (2016). Building Ohio's Future Workforce. Retrieved from workforce.ohio.gov/Portals/0/Building%20Ohio%27s%20Future%20Workforce%20Report.pdf.

[2] Manufacturing Institute (2015). T*he Skills Gap in the U.S. Manufacturing 2015 and Beyond*. Retrieved from www.themanufacturinginstitute.org/~/media/827DBC76533942679A15EF7067A704CD.ashx.

[3] The Ohio Manufacturers' Association (2015). *2015 Ohio Manufacturing Counts*. Retrieved from www.ohiomfg.com/wp-content/uploads/ManufacturingCounts2015.pdf.

10. If the program request is approved, what future growth do you anticipate (e.g., in the next six months, three years) and how do you plan to manage this growth?

Projected enrollment is 10 first-time students in year one of the program, with expectation of 70 students in year four. These numbers don't include enrollment of students transferring from other programs or institutions. Any future faculty hires will be dependent upon student enrollment.

11. How does this program fit into the current and expected financial picture of the institution? In particular, will the program be financially self-sufficient within three years? If not, when do you expect the program to be financially self-sufficient and how do you expect the program to operate until then?

Kent State University operates under a Responsibility Center Management-based (RCM) financial model, where business-type strategies are used to manage and evaluate new and existing programs. Under this model, costs and revenues are taken into consideration when making decisions about the viability of programs. The proposed Mechatronics Engineering major will be no exception, and will undergo the same scrutiny as other.

The proposed degree program is built primarily around existing courses that are required in other engineering and engineering technology programs. Only three new courses will be created for the program at implementation. Therefore, the program can rely on existing faculty, facilities, library resources, equipment and technology (with minor upgrades).

Students in engineering programs undertake a substantial amount of preparatory coursework in mathematics and science in their first two years. Consequently, as the new program builds out to four years, most of the income will flow to those academic departments, rather than to the College of Aeronautics and Engineering.

The college is conservative in its first cohort of 10 students. However, through marketing and word of mouth, the expectation is that first-year enrollment will grow to 28 students, which will result in increased enrollment in students' junior and senior years (when students take engineering coursework). Fiscal projections show the program breaking even in year four of implementation, and then show a net gain in years five through eight. Since the program will be launched using existing facilities, equipment and faculty, investments that must be made in years one through three will be modest and absorbed using college revenue from other programs.

12. What controls are in place to ensure that the information presented to all constituencies in advertising, brochures, and other communications will be accurate?

The Office of the Provost ensures that only faculty- and university-approved program information is included in the University Catalog, degree audit, Explore Programs and Degrees website and student information system (for admission and graduation). Kent State's Division of University Communications and Marketing coordinates branding and consistency of all of the university's promotional materials.

Section D. Curriculum and Instructional Design

13. Please list all the courses that comprise the program and identify if the program will include any new courses. Include course descriptions and number of credit hours for each.

MAJOR REQUIREMENTS

AERN 15300 Introduction to Engineering Analysis Using Matlab® 3 Credit Hours
Introduction to basic concepts in engineering analysis using the Matlab® computing language, the industry-standard "first language" for engineers. Introduction to problem solving, algorithm coding and development, debugging, analysis and interpretation.

TECH 13580 Engineering Graphics I 3 Credit Hours
Technique of engineering drawing, lettering, instrument use, freehand drawing, orthogonal projection, sections, single and double auxiliaries, dimensioning, screw threads, charts and graphs.

TECH 20002 Materials and Processes 3 Credit Hours
Study and practice addressing the nature of basic manufacturing materials and the processes by which they are converted into manufactured products. Includes laboratory experience.

TECH 20004 Fundamentals of Circuit Analysis 4 Credit Hours
Analysis of DC and AC electrical circuits using the basic circuit theorems. Description of AC signals in terms of phasors. Power and resonance in electrical circuits.

TECH 23581 Computer-Aided Engineering Graphics 3 Credit Hours
Study of working drawings, descriptive geometry, geometrical tolerancing, structural/weldments, cams, gears, piping and considerable time with the Hewlett Packard 900 CAD system.

TECH 26010 Introduction to Computer Engineering Technology 3 Credit Hours
Describes Computer Engineering Technology concepts and principles. Topics include computer hardware, computer hardware operations, digital systems design, networking hardware, technology of networking, computer aided design and embedded systems.

TECH 26200 Programming for Engineering I 3 Credit Hours **NEW**
Introduction to engineering problem solving and use of programming language to solve those problems is the base of this course. Students in an engineering major are expected to develop basic mathematical modeling and engineering problem solving skills using mathematical and conventional computational tools. Developing modeling and logical thinking are the core objective of this course.

TECH 33031 Programmable Logic Controllers 3 Credit Hours
An introduction to programmable logic controllers (PLCS) covering hardware, ladder logic programming, networking and communications. Programming timers, counters and sequencers and an introduction to human machine interfaces (HMIS).

TECH 33033 Hydraulics/Pneumatics 3 Credit Hours
Fluid properties, hydraulic design, viscosity, hydraulic components, pumps, systems and circuits, maintenance and safety, pneumatics, air systems control and design.

TECH 33040 Motors and Controllers 3 Credit Hours
AC and DC motors, motor control, and machine operations in mechatronic systems. Includes introduction to basic control system terms and devices, input and output transducers, signal conditioning, open loop and closed loop control, stability and performance.

TECH 33092 Cooperative Education - Professional Development 1-3 Credit Hours
(Repeatable for a maximum of 6 credit hours) Supervised work-study experience in approved business or industrial environment relative to the student's major. The 3 credit hour co-op experience must be for a period of at least 12 consecutive weeks at 40 hours per week, or 30 hours per week for 15 weeks, totaling not less than 450 hours. Most co-ops occur during the summer. Students can earn up to an additional 3 credit hours (one to three per co-op – 150 work hours per credit hour) over the course of their college career as long as each co-op has a different focus.

TECH 33111 Strength of Materials 3 Credit Hours
An analytical study of the relation between the external forces applied to elastic materials and the resulting deformations and stresses.

TECH 33220 Electronic Devices 4 Credit Hours
Introduction to electronic non-linear devices including, diodes, transistors, opotoelectronic devices and operational amplifiers. Use and application of these devices in different types of application like rectifiers, amplifiers and linear integrated circuits.

TECH 33222 Digital Design for Computer Engineering 3 Credit Hours
Introduction to digital design. The operation and use of digital devices and components as used in microprocessors and digital computers. Topics include binary arithmetic operations, Boolean algebra, logic gates, combinational and sequential logic, buffers, registers, memory devices, counters, latches, timers, comparators, encoders, decoders, multiplexers and demultiplexers.

TECH 33363 Metallurgy and Materials Science 3 Credit Hours
Scientific study of modern manufacturing materials (metals, plastics and ceramics) and the laboratory test methods used to determine their manufacturing specifications and properties.

TECH 36200 Programming for Engineering II 3 Credit Hours **NEW**
Emphasizes engineering problems and applications of programming language and mathematical tools to analyze and solve them. Students with engineering major (including mechatronics, mechanical engineering technology and computer engineering technology) are expected to learn problem solving techniques, modeling,

simulation and presentation of engineering application oriented problems using conventional computation and mathematical tools. Advanced modeling, simulations and analysis are the core objectives of this course.

TECH 37666 Kinematics and Dynamics of Machinery 3 Credit Hours **NEW**
The study of the kinematics and dynamics of machinery with an emphasis on links, cams and gears.

TECH 43030 Mechatronics 3 Credit Hours
Application of automation concepts in motion control, electrical circuits, fundamental mechanics, control systems and programming including modeling, interfacing and signal conditioning.

TECH 43031 Mechatronics II 3 Credit Hours
Advanced modeling, system response, closed loop control and system software for mechatronic systems.

TECH 43220 Electrical Machinery 3 Credit Hours
Principles of operation and application of motors, generators, transformers and other magnetic devices; electrical power generation, distribution and use.

TECH 43580 Computer-Aided Machine Design 3 Credit Hours
Description and Prerequisite Data Currently in Banner: Application of the principles of mechanics and strength of materials, with computer assistance to the design and selection of machine components under both static and dynamic loads.

TECH 47200 Systems Engineering 3 Credit Hours
(Slashed with TECH 57200) Systems engineering as a method to solve problems. Introduction to the fundamental systems engineering principles, processes, and methodologies used to analyze, design, develop, and deploy complex, sustainable systems. Focuses on systems engineering as a logical, disciplined, systematic, and coherent approach to the design and development of a system, across the full life cycle of the system. Special emphasis is made on the concepts, methods, and activities used to analyze systems, to define and allocate requirements, to transform requirements into a system design, and to verify and validate the system.

ADDITIONAL REQUIREMENTS

COMM 15000 Introduction to Human Communication 3 Credit Hours
An inquiry into the nature and function of human communication in interpersonal, group and public contexts.

MATH 12002 Analytic Geometry and Calculus I 5 Credit Hours
Concepts of limit, continuity and derivative, and the indefinite and definite integral for functions of one real variable. Maximization, related rates, fundamental theorem of calculus.

MATH 12003 Analytic Geometry and Calculus II 5 Credit Hours
Continued study of techniques and applications of integration; trigonometric, logarithmic and exponential functions; polar coordinates; vectors; parametric equations; sequences and series.

MATH 32051 Mathematical Methods in the Physical Sciences I 4 Credit Hours
Mathematics background beyond calculus I and II for upper-division courses in the physical sciences. Topics include complex numbers and arithmetic, linear algebra, partial differentiation and multiple integrals.

MATH 32052 Mathematical Methods in the Physical Sciences II 4 Credit Hours
Additional mathematics background for upper-division courses in the physical sciences. Topics include vector analysis, Fourier series and transforms ordinary differential equations and partial differential equations.

PHY 23101 General University Physics I 5 Credit Hours
Principles of mechanics, heat and sound at calculus level.

PHY 23102 General University Physics II 5 Credit Hours
Principles of electricity, magnetism, light and modern physics at calculus level.

UC 10097 Destination Kent State: First Year Experience 1 Credit Hour
(Equivalent to UC 10002 or UC 20007) Course assists students in making a successful academic transition to the university through experiential or intellectually engaging discipline-based content. Required of all first year students. Not required of transfer students with 25 or more credit hours.

14. What are the requirements students must fulfill to complete the program successfully (including specific courses, course options, and any other requirements)?

Major Requirements		
AERN 15300	Introduction to Engineering Analysis Using MatLab®	3
TECH 13580	Engineering Graphics I	3
TECH 20002	Materials and Processes	3
TECH 20004	Fundamentals of Circuit Analysis (REVISED)	3
TECH 23581	Computer-Aided Engineering Graphics	3
TECH 26010	Introduction to Computer Engineering Technology	3
TECH 26200	Programming for Engineers I (NEW)	3
TECH 33031	Programmable Logic Controllers	3
TECH 33033	Hydraulics/Pneumatics	3
TECH 33040	Motors and Controllers	3
TECH 33092	Cooperative Education - Professional Development	1
TECH 33111	Strength of Materials	3
TECH 33220	Electronic Devices	4
TECH 33222	Digital Design for Computer Engineering	3
TECH 33363	Metallurgy and Materials Science	3
TECH 36200	Programming for Engineers II (NEW)	3
TECH 37666	Kinematics and Dynamics of Machines (NEW)	3
TECH 43030	Mechatronics	3
TECH 43031	Mechatronics II	3
TECH 43220	Electrical Machinery	3
TECH 43580	Computer-Aided Machine Design	3
TECH 47200	Systems Engineering	3
Additional Requirements		
COMM 15000	Introduction to Human Communication	3
MATH 12002	Analytic Geometry and Calculus I	5
MATH 12003	Analytic Geometry and Calculus II	5
MATH 32051	Mathematical Methods in the Physical Sciences I	4
MATH 32052	Mathematical Methods in the Physical Sciences I	4
PHY 23101	General University Physics I	5
PHY 23102	General University Physics II	5
UC 10097	Destination Kent State First Year Experience	1
Kent Core Composition		6
Kent Core Humanities and Fine Arts (minimum one course from each)		9
Kent Core Social Sciences (must be from two disciplines)		6
Kent Core Additional		3
	Minimum Total Credit Hours:	**121**

15. For programs using prior learning credit, compressed time frames, online delivery, accelerated formats or other approaches to learning, explain how the institution will ensure that student work and the levels of knowledge and competencies comparable to those required in traditional formats have been achieved.

Kent State University has partnered with several secondary school districts and career and technical centers to accept for college credit completion of tech prep education programs in engineering and engineering technology. All tech prep programs in Ohio are required to align with the technical content standards and curriculum as developed by both high school and college faculty and business and industry representatives. Thus, the competencies are the same for all programs in a particular career field state-wide. All students are tested using the same state-wide end-of-course exams, which were developed in collaboration by high school and college faculty.

Section E. Institutional Staffing, Faculty, and Student Support

16. How many and what types of faculty (full-time or part-time) will be employed in the program? Why is the number and type of faculty sufficient to support the program? How many, if any, new faculty will be hired for the program?

    Existing full- and part-time faculty in the College of Aeronautics and Engineering will teach the major courses in the program in the near future. The numbers range from two to 12 full-time (tenured and non-tenure track) faculty and two to six part-time (adjunct) faculty. The range depends on enrollment numbers each year. The college anticipates hiring one or two new tenured or tenure-track faculty as the program matures.

17. What will the impact of the new initiative be on faculty workload?

    There will be no impact on the faculty workload.

18. Provide a brief attachment that inventories each faculty member employed to teach in the program, including names of existing personnel, a description of each faculty member's academic qualifications, their prior instructional responsibility and other experiences relevant to the courses they will teach in the program in question, each faculty member's course load in the new program, and the course work each teaches in other programs currently offered. (Note: Do not attach full CVs for each faculty member; rather, the requested information should be summarized in one paragraph for each faculty member.)

    See Appendix A.

19. For graduate programs, document scholarship and research capability of each faculty member; for doctoral programs, document faculty experience in directing student research.

    Not applicable.

20. What library and information resources—general as well as specific to the program(s)—and staffing and services are in place to support the initiative? If the proposed new program is at the graduate level, document discipline-specific refereed journals and primary source materials.

    Kent State's science librarian, determined whether the collection of print and electronic resources where adequate enough to support the program proposed. The science librarian works closely with the library representative from the college to determine the need for additional resources as needed, and fulfills direct requests from faculty in need of additional resources. There is an annual budget allocated by the library and administered by the science librarian to support the resource needs of the college. In addition, the science librarian teaches information literacy classes that focus on the usage of these materials.

    Book collections: The existing book collection at the Kent State University Library will strongly support the proposed areas of study and research. Existing services the library offers will allow for continued development of this collection. Faculty members have the ability to participate in the selection of new books and journals for the collection. The University Library allocates an annual budget for monograph and journal purchases for the College of Aeronautics and Engineering. The science librarian coordinates requests for these purchases. In addition, for materials not available in the collection, faculty and students may request books through the Interlibrary Loan system.

Journals and subscriptions: Another area of collection support is the University Library's collection of academic periodicals. This collection of journals supports most of the needs of faculty and students research. The collection management librarian and science librarian regularly review interlibrary loan reports from collage to identify new collection needs.

Database collection: The University Library provides access to several databases. The database collection is evaluated each year to ascertain its usefulness to faculty and students, when to acquire new databases, and replace those not of use.

- ACM Digital Library: Provides bibliographic information, abstracts, index terms, reviews and the full-text for ACM conference proceedings. ACM journals, magazines and newsletters are also available at this site, as well as through the OhioLINK Electronic Journal Center.
- AccessScience: An online encyclopedia that provides full-text access to articles, research updates and dictionary terms in all areas of science and technology. Also contains biographies, weekly updates on hot topics and discoveries, a student center with resource guides and links to related sites. Updated daily.
- Computers and Applied Sciences Complete: Incorporates Computer Science Index, Computer Source, Information Science and Technology Abstracts, Internet and Personal Computing Abstracts and includes academic journals, professional publications and other reference sources. Subject areas include the many engineering disciplines, computer theory and new technologies.
- Derwent Innovations Index: Available through the ISI Web of Knowledge interface. Merges the Derwent World Patents Index with the Derwent Patents Citation Index. Provides access to more than 14,800,000 patents with links to cited and citing patents, cited articles and full-text patent data sources. Gives users an overview of inventions in three categories: chemical, electrical and electronic and engineering.
- IEEE/IET Electronic Library (IEL): More than three million full text IEEE journals, conferences and standards, IET journals and conferences, VDE conference papers and all IEEE standards except for the drafts. All content back to 1988 with selected content back to 1872.
- Inspec: Provides access to the world's scientific and technical literature in physics, electrical engineering, electronics, communications, control engineering, computers and computing and information technology; also has significant coverage in areas such as materials science, aeronautics, oceanography, nuclear engineering, geophysics, biomedical engineering and biophysics. Searches Physics Abstracts and more.
- Science Online: Science Online from Facts on File (not the journal Science published by AAAS) presents information on a broad range of scientific disciplines through extensive definitions, essays, diagrams, biographies and experiments.
- Textile Technology Complete: Textile Technology Complete is a scholarly and professional database covering scientific and technological aspects of textile production and processing. Containing over 400 periodical titles, it also draws on current technical reports, books and trade literature. Also includes resources about apparel, home furnishings and polymer industries.

Section F. Evaluation

21. Describe the process for monitoring, evaluating and improving the overall effectiveness and quality of the program, and articulate program-level learning outcomes and objectives.

College faculty will assess and evaluate the program following the existing practices. Various metrics such as course grades, major GPA, time to completion and job placement following graduation will be used to assess the program's student learning outcomes listed below. The data on these metrics are summarized in a program assessment report each year and submitted to Kent State's Office of Accreditation, Assessment and Learning.

The program outcomes are as follows:

- Apply knowledge of mathematics, science and engineering
- Design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturing and sustainability
- Use the techniques, skills and modern engineering tools necessary for engineering practice

Upon matriculation of the program's first cohort, Kent State University will seek accreditation from the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). Faculty will back their learning outcomes and assessment techniques for the courses in this program based on ABET criteria.

See Appendix B for more information on student learning outcomes in the program.

22. Describe the process for assessing and improving student learning, including student persistence and completion, in the new program.

While the traditional means to assess learning are employed with this program, such as quizzes, exams, papers and problem sets, the nature of this program lends itself to a natural assessment process because about half of the courses have a lecture and a lab component to them. This provides students with the opportunity to learn the material during the lecture and then apply what they have learned during the lab. This format allows students to be exposed to the same material more than once, which not only increases their likelihood of learning it but the resulting lab report or project is a good learning assessment tool.

Labs provide an active way to learn which helps students stay engaged. This along with designing the course material so that students will understand how the material is relevant to them, how it applies to their everyday life and how it improves their chances of getting the job they may someday want, increases persistence.

Another way student learning is assessed is through internships. This program does require that every student participate in an internship. The student is required to journal about their experience weekly and write a paper at the end of the semester. This encourages the student to articulate what they have learned which is a good assessment tool. The employer is also asked to evaluate the student and provide feedback about the student's knowledge and performance. Having a "real-world" experience provides the student with the opportunity to understand why they take the courses that they do, implement what they have learned and determine what they may like to do in the future, which increases persistence.

ADDENDUM TO HIGHER LEARNING COMMISSION SUBSTANTIVE CHANGE APPLICATION TO ESTABLISH A NEW UNDERGRADUATE DEGREE PROGRAM

Proposed Major:	Mechatronics Engineering
Proposed Degree:	Bachelor of Science
Administrating College:	College of Aeronautics and Engineering
Administrating Department:	Not applicable

Provide the title of the lead administrator for the proposed program and a brief description of the individual's duties and responsibilities.

Kent State's College of Aeronautics and Engineering, functions as one organizational unit with two separate and distinct program areas: aeronautics and engineering. Each program area is led by a program director.

The proposed Mechatronics Engineering Technology degree program will reside in the engineering program area under the leadership of interim director Jackie Ruller, M.S. Position duties include developing the course schedule, managing the day-to-day requests/issues, pursuing partnerships with industry personnel, writing proposals and serving on committees.

Indicate whether any institutions of higher education offer the proposed program within a 30-mile radius of the campus(es) at which the proposed program will be offered. If so, list the institutions that offer the proposed program and provide a rationale for offering an additional program at this campus.

At present, there are no public universities in Ohio offering a pure mechatronics engineering degree program. There are only four ABET-accredited mechatronics engineering programs in the United States:

1. California State University, Chico
2. Kennesaw State University, Georgia
3. North Carolina State University, Raleigh
4. University of North Carolina, Asheville

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DESCRIPTION

The Bachelor of Science degree in Mechatronics Engineering integrates mechanical, electrical, computer and controls engineering to understand automated machinery, specifically, how to design it and how to make it work. Mechatronics engineering revolves around the design, construction and operation of automated systems, robots and intelligent products, which result from the integration of software and hardware.

Using automated systems is becoming more popular for operating equipment/machinery on manufacturing lines, boilers and aircraft to reduce labor costs, increase precision and accuracy and provide quality and safety for workers.

Mechanical engineers investigate complex electrical/mechanical problems and develop engineering methods to address them. They can work in any company that develops, designs or manufactures and markets these devices. Opportunities exist in manufacturing, sales as well as research.

Fully Offered At:

- Kent Campus

ACCREDITATION

Not applicable

ADMISSION REQUIREMENTS

Admission to the Mechatronics Engineering major is selective.

Freshman Students: Admission into the Mechatronics Engineering major requires minimum 3.000 high school GPA; minimum 24 ACT composite score (minimum 24 ACT subscore in both English and mathematics) or minimum 1700 SAT composite score (mathematics, critical reasoning and writing); and placement directly into MATH 12002 (or its equivalent).

Students who do not meet these requirements may apply for admission to the Mechatronics Engineering Technology major and request to change their program to the Mechatronics Engineering major after their freshman year if they meet the following criteria: minimum 3.200 overall Kent State GPA and minimum B grade in both MATH 12002 and PHY 23101.

Transfer Students: Admission into the Mechatronics Engineering major requires minimum 12 credit hours in college-level coursework with a minimum 3.200 overall GPA and a minimum B grade in both MATH 12002 and PHY 23101 (or their equivalents). Transfer students who have completed less than 12 credit hours of college-level coursework will be evaluated on both collegiate and high school records and must submit a final high school transcript and an ACT or SAT score.

English Language Proficiency Requirements for International Students: All international students must provide proof of English language proficiency (unless they meet specific exceptions) by earning a minimum 525 TOEFL score (71 on the Internet-based version), minimum 75 MELAB score, minimum 6.0 IELTS score or minimum 48 PTE Academic score, or by completing the ELS level 112 Intensive Program. For more information on international admission, visit the Office of Global Education's admission website.

PROGRAM LEARNING OUTCOMES

Graduates of this program will be able to:

1. Apply knowledge of mathematics, science and engineering
2. Design a system, component or process to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturing and sustainability
3. Use the techniques, skills and modern engineering tools necessary for engineering practice.

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PROGRAM REQUIREMENTS

Major Requirements (courses count in major GPA)		
AERN 15300	Introduction to Engineering Analysis Using MatLab®	3
TECH 13580	Engineering Graphics I	3
TECH 20002	Materials and Processes	3
TECH 20004	Fundamentals of Circuit Analysis (REVISED)	3
TECH 23581	Computer-Aided Engineering Graphics	3
TECH 26010	Introduction to Computer Engineering Technology	3
TECH 26200	Programming for Engineers I (NEW)	3
TECH 33031	Programmable Logic Controllers	3
TECH 33033	Hydraulics/Pneumatics	3
TECH 33040	Motors and Controllers	3
TECH 33092	Cooperative Education - Professional Development (ELR) (WIC)[1]	1
TECH 33111	Strength of Materials	3
TECH 33220	Electronic Devices	4
TECH 33222	Digital Design for Computer Engineering	3
TECH 33363	Metallurgy and Materials Science	3
TECH 36200	Programming for Engineers II (NEW)	3
TECH 37666	Kinematics and Dynamics of Machines (NEW)	3
TECH 43030	Mechatronics	3
TECH 43031	Mechatronics II	3
TECH 43220	Electrical Machinery	3
TECH 43580	Computer-Aided Machine Design	3
TECH 47200	Systems Engineering	3
Additional Requirements (courses do not count in major GPA)		
COMM 15000	Introduction to Human Communication (KADL)	3
MATH 12002	Analytic Geometry and Calculus I (KMCR)	5
MATH 12003	Analytic Geometry and Calculus II	5
MATH 32051	Mathematical Methods in the Physical Sciences I	4
MATH 32052	Mathematical Methods in the Physical Sciences I	4
PHY 23101	General University Physics I (KBS) (KLAB)	5
PHY 23102	General University Physics II (KBS) (KLAB)	5
UC 10097	Destination Kent State First Year Experience	1
Kent Core Composition		6
Kent Core Humanities and Fine Arts (minimum one course from each)		9
Kent Core Social Sciences (must be from two disciplines)		6
Kent Core Additional		3
	Minimum Total Credit Hours:	**121**

1. A minimum C grade must be earned to fulfill writing-intensive requirement.

Graduation Requirements:

- Minimum Major GPA: 2.250
- Minimum Overall GPA: 2.000

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ROADMAP

Semester One		
MATH 12002	Analytic Geometry and Calculus I (KMCR)	5
TECH 13580	Engineering Graphics I	3
TECH 20002	Materials and Processes	3
UC 10097	Destination Kent State: First Year Experience	1
Kent Core Requirement		3
	Credit Hours:	**15**
Semester Two		
MATH 12003	Analytic Geometry and Calculus II	5
PHY 23101	General University Physics I (KBS) (KLAB)	5
TECH 26010	Introduction to Computer Engineering Technology	3
Kent Core Requirement		3
	Credit Hours:	**16**
Semester Three		
AERN 15300	Introduction to Engineering Analysis Using MatLab®	3
MATH 32051	Mathematical Methods in the Physical Sciences I	4
PHY 23102	General University Physics II (KBS) (KLAB)	5
TECH 33111	Strength of Materials	3
	Credit Hours:	**15**
Semester Four		
COMM 15000	Introduction to Human Communication (KADL)	3
MATH 32052	Mathematical Methods in the Physical Sciences II	4
TECH 20004	Fundamentals of Circuit Analysis	3
TECH 37666	Kinematics and Dynamics of Machines	3
Kent Core Requirement		3
	Credit Hours:	**16**
Semester Five		
TECH 23581	Computer-Aided Engineering Graphics	3
TECH 33031	Programmable Logic Controllers	3
TECH 33033	Hydraulics/Pneumatics	3
TECH 33220	Electrical Devices	4
Kent Core Requirement		3
	Credit Hours:	**16**
Semester Six		
TECH 26200	Programming for Engineers I	3
TECH 33040	Motors and Controllers	3
TECH 33363	Metallurgy and Material Science	3
TECH 43580	Computer-Aided Machine Design	3
Kent Core Requirement		3
	Credit Hours:	**15**
Semester Seven		
TECH 33222	Digital Design for Computer Engineering	3
TECH 36200	Programming for Engineers II	3
TECH 43030	Mechatronics	3
TECH 47200	System Engineering	3
Kent Core Requirement		3
	Credit Hours:	**15**
Semester Eight		
TECH 33092	Cooperative Education - Professional Development (ELR) (WIC)	1
TECH 43031	Mechatronics II	3
TECH 43220	Electrical Machinery	3
Kent Core Requirement		3
Kent Core Requirement		3
	Credit Hours:	**13**
	Minimum Total Credit Hours:	**121**

Robert G. Sines, Jr.
Interim Dean
College of Aeronautics and Engineering
1400 Lefton Esplanade
Kent, Ohio 44240

Dear Mr. Sines:

My name is Kevin Ballard. I am 2010 graduate of your college and now serve as the Production Engineering Manager at Rambus' Lighting Division in Brecksville, OH. At Rambus, I lead a team that is charged with development of new manufacturing processes and technologies that enable our company to produce our industry leading product designs.

I would like to express my support of Kent State's proposed Mechatronics Engineering, Mechatronics Engineering Technology, Computer Engineering Technology and Mechanical Engineering Technology programs. Over the next five years, we will need to hire graduates with experience in articulated robotics, machine vision, machine safety, factory data analytics, and lean manufacturing.

It is difficult to find young talent that has any controls engineering expertise, or an understanding of how manufacturing systems, and the data they generate can be utilized to improve the operation of the business as a whole. It is also difficult to find people of any age that truly understand how the design of the equipment, robotics, and plant floor directly affect performance and uptime of the operation.

In addition to the in-class curriculum, we would be very interested in co-op or internship programs that expose your students to real world projects and opportunities. Again, this type of experience would provide your students with an important advantage when compared to other recent graduates.

With almost all Co-Ops, or traditional Mechanical Engineers that I have worked with thus-far, we have found very little comprehension of the concepts outlined above. The education background I received at Kent State has given me a unique advantage because I was able to build on the concepts from the moment I left school. We feel the lack of talent and knowledge in this field every day, whether it be through our own organization, or our suppliers of production equipment. With that being said, I believe that the prospects will continue to improve, for graduates of your programs.

Sincerely,

Kevin Ballard
Production Engineering Manager
Rambus Lighting Division
6611 W. Snowville Rd.
Brecksville, OH 44319
Kballard@rambus.com

Robert G. Sines, Jr.
Interim Dean
College of Aeronautics and Engineering
1400 Lefton Esplanade
Kent, Ohio 44240

Dear Mr. Sines:

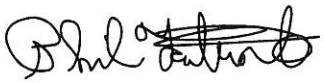
AMETEK HKP would like to express its support of Kent State's proposed Mechatronics Engineering, Mechatronics Engineering Technology, Computer Engineering Technology and Mechanical Engineering Technology programs. Over the next 5 years, we will need to hire graduates with experience in CAD, controls expertise, applying and testing stepper and servo motors and controls, and systems design.

It is difficult to find young talent that has theoretical and hands on electro-mechanical expertise. Thus, these programs resulting in graduates with a high level of knowledge as well as graduates with significant experience in the application, design, and use of today's machine control system architectures would give them a significant competitive advantage entering the workforce. All programs would provide graduates that would be a valuable resource of future employees for AMETEK.

In addition to the in-class curriculum, we would be very interested in co-op or internship programs that expose your students to real world projects and opportunities. Again, this type of experience would provide your students with an important advantage when compared to other recent graduates.

Key industries such as consumer goods, life sciences, food and beverage, tire and automotive manufacturing are facing workforce shortages and the engineering and technical skills to design and maintain automated, mechanical and electrical systems is critical to their success.

Regards,



Phil Faluotico

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North Central State College

October 18, 2017

Chancellor John Carey
Department of Higher Education
25 South Front Street
Columbus, Ohio 43215

Dear Chancellor Carey:

I am writing this letter on behalf of North Central State College to express support for the engineering programs in the College of Aeronautics and Engineering (CAE) at Kent State University. A goal of ours is to provide our students with different pathways and good opportunities when they leave North Central State College. Consequently, we have been working with staff and faculty at Kent State to create pathways for our students in which they would earn college credit from our institution that may be applied to programs in CAE. In particular, CAE would like to move three of the concentrations (mechatronics engineering technology, computer engineering technology and mechanical engineering technology) under the Bachelor of Science in Applied Engineering program to their own major. As majors, the programs would be more visible and there would be more flexibility in the curriculum. These programs complement our associate level programs and can provide a valuable next step in a student's career pathway.

One of the reasons that the programs in CAE are such a good fit for our programs is their applied nature. I understand that CAE is participating in the NEO RAPIDS 2 proposal in the hope of acquiring a FANUC Integrated Cell. Our students in our engineering tech programs have the opportunity to receive training on FANUC robots. Having the opportunity to work with the FANUC Integration Cell at Kent State is again, the perfect complement to the training they receive with us.

In addition, I understand that CAE would like to offer the more theoretical mechatronics engineering program beginning fall of 2018. This program will offer a higher level of math and theory providing an additional pathway for our students who are progressing along calculus pathways in engineering and may prefer careers with a stronger theoretical focus.

In short, we are impressed with the work being done to move CAE forward and make it a stronger partner with community colleges.

Respectfully,

Greg Timberlake, Psy.D.
Dean of Business, Industry, Technology, &
Workforce Development
North Central State College

2441 Kenwood Circle
Mansfield, OH 44906
419.755.4800
888.755.4899
www.ncstatecollege.edu

Ruller, Jackie

From: Rachel S. Heidenreich <rsheidenreich@ra.rockwell.com>
Sent: Wednesday, January 18, 2017 4:31 PM
To: Sines, Robert
Cc: Ruller, Jackie
Subject: Kent State's Proposed Mechatronics Programs

Rockwell Automation (RA) would like to express its support of Kent State's proposed Mechatronics Engineering and Mechatronics Engineering Technology programs. RA and our customers have definite needs for students with experience in mechatronics, including controls expertise, working with motors, ability to program PLC's, etc. Here are some specific examples of applicability:

- Machine builders, systems integrators and distributors are all struggling to find young talent that has controls application expertise. Thus, these programs resulting in graduates with high level or theoretical experience using or designing machine control architectures as well as graduates with significant experience in the application, design, and use of today's machine control system architectures would give them a significant competitive advantage entering the workforce. Both programs would very much support our customers as well as RA as a source of future employees.
- In addition to the in-class curriculum, RA and our customers would be very interested in co-op or internship programs that expose your students to real world projects and opportunities. Again, this type of experience would provide your students with an important advantage when compared to other recent graduates.
- The applied nature of the program lends itself well to RA's sales resources that are focused on OEM's as well as our customer facing engineers that supply solutions to our customers in discrete manufacturing.
- Our customers with discrete manufacturing in key industries such as consumer goods, life sciences, food and beverage, tire and automotive manufacturing are facing workforce shortages and the engineering and technical skills to design and maintain mechanical and electrical systems is critical to their success.

As RA and many customers are located in the Midwest, it can be difficult to identify talent that is willing to relocate here. These types of skills are of particular interest in Ohio and the Midwest, so students attending school in this area are also be a good match to the opportunities here.

Sincerely,

Rachel Heidenreich
VP Quality and Continuous Improvement
Rockwell Automation

KENT STATE UNIVERSITY | TUSCARAWAS

December 15, 2016

To Whom It May Concern:

It is gratifying to see just as Kent State University has taken the lead in innovative technologies such as liquid crystals, now the College of Applied Engineering, Sustainability and Technology, with great foresight, will offer a degree in Mechatronics Engineering.

Mechatronics Engineering is a multidisciplinary field of engineering whose name suggests simply the combination of mechanical and electrical engineering, but it also encompasses electronics, computer engineering, telecommunications engineering, systems engineering and control engineering. As manufacturing in the United States has become more automated, there is a need for engineering with such a wide range of capabilities.

As a major university in Northeast Ohio it is fitting that Kent State offer this as a new major. Edd Pritchard records in a September 19, 2016 Canton Repository article "Manufacturing remains a key part of Northeast Ohio's economy and has become more diversified over the last 50 years, according to a report from Team Northeast Ohio". In addition, Team NEO reports "Manufacturing is the largest sector of North East Ohio's gross regional product and should hold that position in the coming years, because advanced manufacturing areas are growing." According to Ethan Karp, president and CEO of MAGNET, "Using robotic equipment and digital manufacturing techniques helps companies improve productivity."

Edd Pritchard goes on to observe; manufacturers also have been taking steps to reduce costs by bringing in new technologies. "Cost cutting over the past 20 years has been part of an effort to remain competitive with overseas manufacturers," said Ethan Karp, president and CEO of MAGNET, the Manufacturing Advocacy and Growth Network. "Using robotic equipment and digital manufacturing techniques helps companies improve productivity," he said. For that reason, Team NEO believes there will be opportunities for manufacturing jobs in the future.

To meet these high tech manufacturing needs, mechatronic engineers will be needed in Northeast Ohio. As the Director of Engineering Technology at Kent State University at Tuscarawas, I support this move.

Sincerely,

Paul Dykshoorn
Director, Engineering Technology