APPENDIX A – FACULTY FOR THE PROPOSED B.S. IN MECHATRONICS ENGINEERING

Md Amiruzzaman, Ph.D.

Position: Assistant Professor, College of Aeronautics and Engineering
Degrees: B.S., Computer Science (2006), National University
M.S., Computer Science (2011), Kent State University
M.Tech., Technology (2015), Kent State University
Ph.D., Curriculum and Instruction (2016), Kent State University

Before accepting a teaching position at Kent State University in 2016, Dr. Amiruzzaman worked as a computer programmer for nearly 10 years for several companies, both nationally and internationally. In addition, he has worked as a research assistant at Sejong University and Korea University. Prior to Kent State University, he taught at the National University and Korea University.

Dr. Amiruzzaman teaches 15 credit hours in the college each semester. He teaches the following required courses in the proposed major, which are also required in other college programs:

- TECH 23581 Computer-Aided Engineering Graphics
- TECH 26200 Programming for Engineers I
- TECH 36200 Programming for Engineers II

Darwin L. Boyd, Ph.D.

Position: Assistant Professor, College of Aeronautics and Engineering
Degrees: B.S., Physics (1982), Kent State University
M.A., Physics (1988), Kent State University
Ph.D., Physics (1991), Kent State University

Dr. Boyd worked as a research associate at NASA Lewis Research Center, in Cleveland, from 1990 to 1997. He has been a faculty member at Kent State University since 1994. He was also a NASA-ASEE summer faculty fellow at NASA Lewis Research Center, from 1996 to 1999. Dr. Boyd's research experience includes the study of Mössbauer effects in spin crossover systems and liquid crystals and the use of x-ray photoelectron spectroscopy and Auger electron microscopy in the study of metallic and ceramic materials. He also has worked in the design of ultra-high-vacuum systems, and has done extensive work in the design and implementation of computer-based data acquisition systems for numerous applications in laboratory environments. Currently, his research interests include the characterization of metal matrix and ceramic matrix composite materials using Auger electron spectroscopy. Dr. Boyd is a member of the Association of Technology, Management and Applied Engineering (ATMAE).

Dr. Boyd teaches a minimum of 12 credits in the college each semester. He teaches the following required courses in the proposed major, which are also required in other college programs:

- TECH 33031 Programmable Logic Controllers
- TECH 43030 Mechatronics
- TECH 43031 Mechatronics II
- TECH 43220 Electrical Machinery

John C. Duncan, Ph.D.

Position: Assistant Professor, College of Aeronautics and Engineering
Degrees: B.S., Aerospace Engineering Technology (1981), Kent State University
B.S., Electronics (1982), Chapman University
M.A., Technology (1988), Kent State University
Ph.D., Evaluation and Measurement (1996), Kent State University

In his more than 25 years at Kent State University, Dr. Duncan has taught a wide variety of undergraduate and graduate aeronautics courses, and has extensive experience in curriculum design and distance learning delivery methods. He has more than 40 years of experience in aviation, in a variety of areas and roles. He has substantial professional engineering and flight training/simulation experience, extensive experience in flight training and flight simulator design engineering. He has worked as a research scientist in aviation human factors research and has served as a curriculum and course evaluator for the American Council on Education since 1993. Dr. Duncan is a licensed pilot with an Advanced Ground Instructor (AGI) rating.

Dr. Duncan teaches 12 credit hours in the college each semester. He teaches the following required course in the proposed major, which is also required in other college programs:

- TECH 47200 Systems Engineering

Michael R. Fisch, Ph.D.

Position: Assistant Professor, College of Aeronautics and Engineering
Degrees: B.S., Physics (1974), John Carroll University
M.A., Physics (1975), John Carroll University
Ph.D., Applied Physics (1982), Harvard University

Dr. Fisch has worked at Kent State since 1998. His affiliations include the Institute of Electrical and Electronics Engineers (IEEE), American Physical Society (APS) and American Chemical Society (ACS).

Dr. Fisch teaches 6 credit hours in the college each semester. He teaches the following required courses in the proposed major, which are also required in other college programs:

- TECH 33033 Hydraulics/Pneumatics
- TECH 33111 Strength of Materials
- TECH 33363 Metallurgy and Materials Science
- TECH 37666 Kinematics and Dynamics of Machines

Brian T. Gardner, M.Tech.

Position: Lecturer, College of Aeronautics and Engineering
Degrees: B.S., Technology (2006), Kent State University
M.Tech., Technology (2013), Kent State University

Mr. Gardner has worked in the information technology industry since 1998. During that time, he has focused on client network integration. With the rapid evolution and industry adoption of wireless systems, Mr. Gardner has studied extensively on extending the functionality of wireless network systems beyond the typical client access model. These efforts involve detailed analysis of wireless systems requirements engineering based on environmental factors and client needs with an ultimate goal of enhanced performance over traditional guided media systems.

Mr. Gardner teaches 15 credit hours in the college each semester. He teaches the following required course in the proposed major, which is also required in other college programs:

- TECH 33222 Digital Design for Computer Engineering

Ronald D. Griswold, M.Tech.

Position: Adjunct, College of Aeronautics and Engineering
Degrees: M.Tech., Technology (2012), Kent State University

Mr. Griswold was an assistant professor for Kent State's mechanical engineering technology programs for 14 years, as well as an instructor at Youngstown State University. He has been a part-time instructor for both universities since 2015. He is a registered professional engineering in Ohio, and has professional experience as a tool and die maker, structural engineer, tooling engineer and construction engineer.

Mr. Griswold teaches 9 credit hours in the college each semester. He teaches the following required course in the proposed major, which is also required in other college programs:

- TECH 43580 Computer-Aided Machine Design

Evren Koptur, Ph.D.

Position: Lecturer, College of Aeronautics and Engineering
Degrees: B.S., Computer Engineering (2003), University of Bahçeşehir (Turkey)
M.Tech., Technology (2005), Kent State University
Ph.D., Educational Psychology (2016), Kent State University

Dr. Koptur professional experiences includes IT support and technical services, where he developed and tested new inventory management system using SQL and new financial reporting system using Visual

Basic, built local area networks, provided object-oriented design, programming and implementation support to the customer billing system, written in C++, prepared test plans and data, and user documentation for customer billing system.

Dr. Koptur teaches 15 credit hours in the college each semester. He teaches the following required course in the proposed major, which is also required in other college programs:

- TECH 26010 Introduction to Computer Engineering Technology

Nuttapong Phantkankum, M.Eng.

Position: Adjunct, College of Aeronautics and Engineering
Degrees: B.Eng., Electronics (2004), King Mongkut's Institute of Technology (Thailand)
M.Eng., Mechanical Engineering (2008), Chiang Mai University (Thailand)
M.Tech., Technology (2015), Kent State University

Mr. Phantkankum has been a part time instructor at Kent State University since 2016. He teaches 9 credit hours in the college each semester. He teaches the following required course in the proposed major, which is also required in other college programs:

- TECH 13580 Engineering Graphics I

Dr. Shin-Min Song, Ph.D.

Position: Professor, College of Aeronautics and Engineering
Degrees: B.S., Mechanical Engineering (1973), Tatung Institute of Technology (Taipei)
M.S., Mechanical Engineering (1981), The Ohio State University
Ph.D., Mechanical Engineering (1984), The Ohio State University

In his over 30 years of higher education professional career, Dr. Song has served as a professor in University of Illinois at Chicago, department chair in Northern Illinois University and dean of College of Applied Engineering, Sustainability and Technology of Kent State University. His teaching, scholarship and research interests include mechanical design, kinematics and dynamics, robotics, walking machines, automation, computer-aided design, computer-integrated manufacturing, energy and power, hydraulics and pneumatics and control theories. He has published and presented extensively in areas of his technical expertise. He has received the NSF Presidential Young Investigator Award and ASME Fellow.

Dr. Song teaches 9 credit hours in the college each semester. He teaches the following required course in the proposed major, which is also required in other college programs:

- TECH 33040 Motors and Controllers

D. Blake Stringer, Ph.D.

Position: Assistant Professor, College of Aeronautics and Engineering
Degrees: B.S., Mechanical Engineering, Aerospace (1993), U.S. Military Academy
M.S., Aerospace Engineering (2003), Georgia Institute of Technology
Ph.D., Mechanical and Aerospace Engineering (2008), University of Virginia

Dr. Stringer is responsible for developing an aerospace engineering curriculum to expand the aeronautics program, for teaching and administering assigned courses, and for establishing an aerospace-related research program and laboratory at Kent State. He is a very active member of the Phastar initiative to reopen the newly named Davis Aerospace and Maritime High School. Served as chief of the Propulsion Division of the Army Research Laboratory where he developed and refined division strategy, research goals, and manpower requirements, following the BRAC relocation, and supported the Army's Research, Development, and Engineering Command's (RDECOM) Mobility & Logistics Technology Focus Team in the areas of drives, engines, propulsion materials, and rotorcraft propulsion technology, among many other significant accomplishments.

Dr. Stringer teaches 6 credit hours in the college each semester. He teaches the following required course in the proposed major, which is also required in other college programs:

- AERN 15300 Introduction to Engineering Analysis Using MatLab®

Trent True, M.Tech.

Position: Lecturer-FEF Key Professor, College of Aeronautics and Engineering
Degrees: B.S., Technology (2005), Kent State University
M.Tech., Technology (2007), Kent State University

After eight years working as a foundry process engineer and production supervisor for Harrison Steel, Mr. True joined Kent State University in 2004. He is a member of the American Foundry Society, Foundry Educational Foundation, Steel Founders' Society of America and Epsilon Pi Tau, and has expertise in metal casting, manufacturing and lean tools.

Mr. True teaches 11-15 credit hours in the college each semester. He teaches the following required courses in the proposed major, which are also required in other college programs:

- TECH 20002 Materials and Processes
- TECH 33092 Cooperative Education - Professional Development

Roberto Uribe-Rendon, Ph.D.

Position: Professor, College of Aeronautics and Engineering
Degrees: B.S., Physics (1973), National Autonomous University of Mexico
M.S., Nuclear Sciences (1979), National Autonomous University of Mexico
Ph.D., Physics (1986), National Autonomous University of Mexico

Dr. Uribe-Rendon's research interests are in the areas of radiation effects in materials, as well as in radiation measurements and standards specifically in the development of techniques used to measure the energy absorbed by materials during electron beam irradiations. Work related to this area comprises experiments in the NEO Beam facility for several research institutions as well as private companies interested in studying the effects of radiation in semiconductor and solar cell materials for space applications as well as in food and polymeric materials.

Dr. Uribe-Rendon teaches 15 credit hours in the college each semester. He teaches the following required courses in the proposed major, which are also required in other college programs:

- TECH 20004 Fundamentals of Circuit Analysis
- TECH 33220 Electronic Devices

Adam Zuckerman, M.Tech.

Position: Adjunct, College of Aeronautics and Engineering
Degrees: B.S., Technology (2008), Kent State University
M.Tech., Technology (2009), Kent State University

Mr. Zuckerman is a prototyping specialist and is focused on developing intellectual property, modeling, simulation and prototyping. Over his 10 years of teaching at Kent State University, Mr. Zuckerman has developed content for Battelle Memorial Institute, 3rd Frontier, NASA and many departments at Kent State University. He also focuses on developing properties for small businesses related to small business manufacturing and has led efforts at Kent State's small business development centers for over 14 years. In his roles, he involves students in taking the initial steps in creating documentation as part of creation process of intellectual property.

Mr. Zuckerman teaches 6-9 credit hours in the college each semester. He teaches the following required courses in the proposed major, which are also required in other college programs:

- TECH 13580 Engineering Graphics I
- TECH 23581 Computer-Aided Engineering Graphics

Kent State University
Fiscal Impact Statement

	Year 1	Year 2	Year 3	Year 4
I. Projected Enrollment				
Headcount full-time	10	25	45	70
Headcount part-time				
Full-time equivalent (FTE) enrollment	10	25	45	70
II. Projected Program Income				
Tuition (total for KSU)	$ 97,039	$ 233,104	$ 414,647	$ 633,949
Expected state subsidy (total for KSU)	$ 30,633	$ 73,585	$ 130,893	$ 200,120
Externally funded stipends, as applicable	$ -	$ -	$ -	$ -
Other Income	$ -	$ -	$ -	$ -
Total Projected Program Income	**$ 127,672**	**$ 306,689**	**$ 545,539**	**$ 834,069**
III. Program Expenses				
New personnel:				
- Instruction				
Full-time: 0				
Part-time: 0				
-Non-instruction				
Full-time: 0				
Part-time: 0				
Current personnel:				
- Instruction				
Full-time: 2 to 12 (Currently paid under existing programs)	$ 3,162	$ 32,069	$ 68,467	$ 113,725
Part-time: 2 to 6 (Currently paid under existing programs)	$ 3,485	$ 5,688	$ 11,797	$ 17,445
-Non-instruction				
Full-time: 0		$ -	$ -	$ -
Part-time: 0	$ -	$ -	$ -	$ -
Benefits for all personnel	$ 1,711	$ 12,911	$ 27,513	$ 45,377
New facilities/building/space renovation (describe in narrative below)	$ -	$ -	$ -	$ -
Scholarship/stipend support	$ 6,000	$ 14,000	$ 24,000	$ 34,000
Additional library resources	$ 250	$ 500	$ 750	$ 1,000
Additonal technology or equipment needs	$ 2,000	$ 4,000	$ 6,000	$ 6,000
Other expenses (see below)	$ 104,235	$ 243,413	$ 412,534	$ 614,624
Total Projected Program Expenses	**$ 120,843**	**$ 312,580**	**$ 551,061**	**$ 832,172**
Projected Program Net	**$ 6,829**	**$ (5,891)**	**$ (5,521)**	**$ 1,897**

Other Expenses				
Allocation of expenses covered by general fee	$ -	$ -	$ -	$ -
RCM overhead - estimated at 50%	$ 25,741	$ 67,193	$ 140,545	$ 230,794
RCM tuition+SSI allocation to other colleges (pays expenses of other colleges)	$ 76,189	$ 172,304	$ 264,449	$ 372,480
Professional development	$ 1,104	$ 2,517	$ 5,940	$ 9,550
Supplies (office, computer software, duplication, printing)	$ 100	$ 200	$ 300	$ 400
Telephone, network, and lines	$ 100	$ 200	$ 300	$ 400
Other info and communication pool	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Total Other Expenses	**$ 104,235**	**$ 243,413**	**$ 412,534**	**$ 614,624**

BUDGET NARRATIVE:
[This section is for describing facilities, scholarship/stipend support, library resources, additional technology, etc., if applicable.]

This program is primarily built around existing courses, so it will use existing facilities, library resources, equipment and technology with minor upgrades that are shared with existing programs.

The technology and equipment line includes some added resources each year. This also is for consumables in the lab courses.

A minor amount of marketing and promotion of this program are included under Other info and communications pool.

Allowances are provided for professional development, supplies, and telephone, network and lines.

Scholarship funds targeting this program are provided. This launches with three $2000 scholarships and increases to five by Year 4. All scholarships are assumed to continue for four years.

Mechatronics Engineering:

There are very few mechatronics engineering programs across the country. Purdue University-Calumet, California State University in Chico, CA and Kennesaw State University in Georgia are currently the only three ABET- accredited[1] in the United States. At present, there are no public universities in Ohio offering a pure Mechatronics Engineering degree program.

A Mechatronics Engineering program is the logical evolution to the investment made by the state for the robotics and advanced manufacturing technology education collaborative (RAMTEC). While Tri-Rivers and their partner career centers have used the $14.9 million[2] to address the skills gap in Ohio by preparing high school and adult students with advanced manufacturing and engineering skills, to professionally advance within many companies, oftentimes employers require a bachelor's degree. See Table 1 below for some statistics relating to the robotics industry[3]. The Mechatronics engineering program will offer graduates from the RAMTEC school, an opportunity to pursue a bachelor degree in this field. The goal is to establish technical prep/articulation agreements with the RAMTEC organizations so that Kent State will be the next step in their educational progression.

Table 1: Robotic Industry Data[3]

Robots Shipped in North America in 2013	Predicted Size of Robotics Industry by 2020	Robotics Related Jobs Opening Every Year
22, 591	$14.2 Billion	500,000

In addition, Kent State University offered its first pure engineering program, the Bachelor of Science in Aerospace Engineering in fall 2016. Adding a pure Mechatronics Engineering program will further strengthen and complement the existing programs, giving students more options. The skill set possessed by mechatronics engineers is highly desired in the automotive, aerospace and consumer products sectors and those technology firms that supply and manufacture software components and equipment.

According to the National Association of College and Employers (NACE), the top-paid engineering graduates for the class of 2015 were mechatronics engineering majors; see Table 2 below. Table 3 shows data from 2014 and mechatronics didn't even make the list which indicates that this is a quickly growing field.

1 ABET (formerly Accreditation Board for Engineering and Technology) accredits more than 3,100 programs at more than 600 colleges and universities worldwide. ABET accredits Kent State's associate degrees in mechanical engineering technology and electrical/electronic engineering technology.

2 https://tririvers.com/ramtec-consortium-receives-14-99-million-straight-a-grant-2/

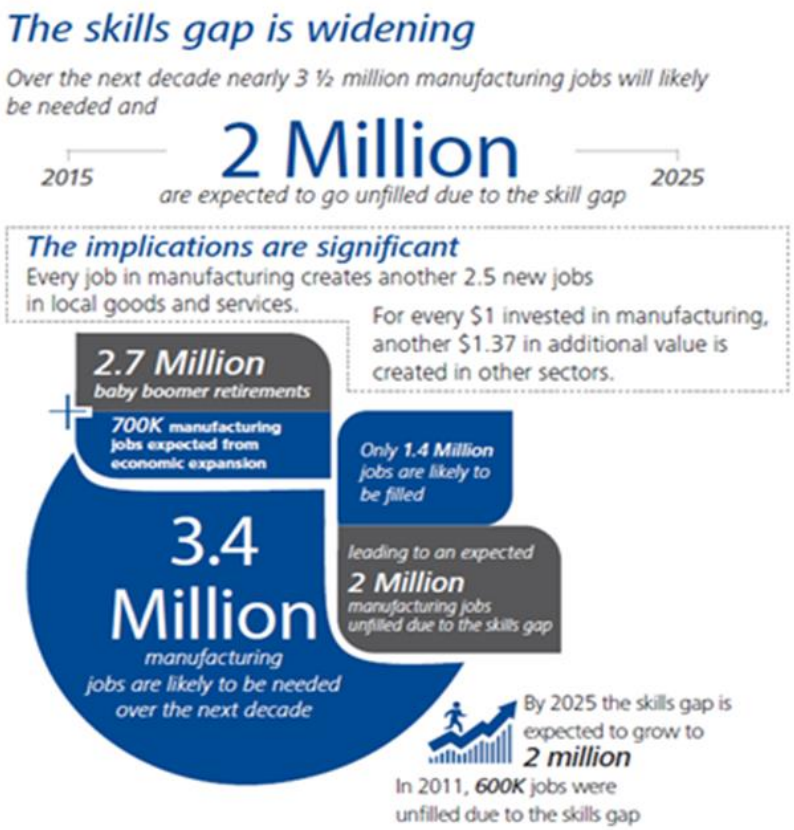
3 http://www.ramtecohio.com/training/high-school/advanced-machining/ and http://www.ramtecohio.com/training/high-school/engineering-technologies/

Table 2: Top-Paid Class of 2015 Engineering Majors[4]

Mechatronics Engineering	$80,859
Petroleum Engineering	$74,996
Computer Engineering	$68,820
Aerospace Engineering	$67,658
Electrical Engineering	$67,593

Table 3: Top-paid Class of 2014 Engineering Majors[5]

Petroleum Engineering	$86,255
Electrical Engineering	$68,778
Mining Engineering	$68,153
Chemical Engineering	$68,061
Computer Engineering	$68,053



[4] Source: *Class of 2015 First-Destination Survey*, National Association of Colleges and Employers. All data are for bachelor's degree graduates and represent initial post-graduation outcomes as of December 31, 2015.

[5] Source: *Class of 2014 First-Destination Survey*, National Association of Colleges and Employers. All data are for bachelor's degree graduates and represent initial post-graduation outcomes as of December 31, 2014.

The Governor's Office Workforce Transformation (OWT) 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." [6]

According to a recent Gallup study, "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." These statistics were taken from Deloitte analysis based on data from the U.S. Bureau of Labor. There is a serious and growing skills gap in U.S. manufacturing and as the following illustrations indicates, this resonates throughout the entire economy.[6]

According to http://www.ohiomfg.com/wp-content/uploads/ManufacturingCounts2015.pdf the Ohio manufacturing sector was 4th in the nation and has 5.6% of manufacturing jobs in the US. Using 2.7 million jobs as the base, this means Ohio must replace about 151,000 workers. While not all these jobs will be in mechatronics, even 1% would correspond to a demand for 1500 new employees with mechatronics credentials. At 20 graduates per year, this would correspond to less than 20% of the demand. Clearly, the demand is substantially greater than our initial ability to meet it. This strongly suggests that this program start as soon as possible. We anticipate needing more faculty members as the program grows, but the increase in students will allow hiring other faculty members economically viable. [7]

This data has been used in planning as discussed above. The program initially grew from faculty interests in research and teaching. This strong personal interest by faculty members leads them to want a high quality program vetted through external evaluations by employers, graduates and ABET accreditation

6 Building Ohio's Future Workforce, Governor's Office of Workforce Transformation. December 31, 2016

7 The Skills Gap in the U.S. Manufacturing 2015 and beyond. Deloitte. Manufacturing Institute. 2015

MECHATRONICS ENGINEERING – B.S.
Student Learning Outcomes – Major Course Mapping

Major Course ID and Title	Student Learning Outcome 1: an ability to apply knowledge of mathematics, science, and engineering			Student Learning Outcome 2: an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability			Student Learning Outcome 3: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.		
	Introduced	Reinforced	Mastered	Introduced	Reinforced	Mastered	Introduced	Reinforced	Mastered
TECH13580 Engineering Graphics I	✓			✓			✓		
TECH20002 Materials and Processes	✓						✓		
TECH26010 Introduction to Computer Engineering Technology	✓						✓		
TECH33111 Strength of Materials		✓		✓					
AERN15300 Introduction to MatLab	✓						✓		
TECH20004 Fundamentals of Circuit Anlaysis		✓						✓	
TECH Kinematics and Dynamics of Machines									
TECH33031 Programmable Logic Controllers	✓			✓			✓		
TECH23581 Computer-Aided Engineering Graphics	✓				✓			✓	
TECH33220 Electronic Devices									
TECH33033 Hydraulics/Pneumatics		✓		✓			✓		
TECH33363 Metallurgy and Materials Science		✓		✓			✓		

	Student Learning Outcome 1: an ability to apply knowledge of mathematics, science, and engineering			Student Learning Outcome 2: an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability			Student Learning Outcome 3: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.		
Major Course ID and Title	Introduced	Reinforced	Mastered	Introduced	Reinforced	Mastered	Introduced	Reinforced	Mastered
TECH43580 Computer-Aided Machine Design			✓			✓		✓	
TECH33040 Motors and Controllers			✓						
TECH26200 Programming for Engineers I	✓						✓		
TECH36200 Programming for Engineers II		✓						✓	
TECH33222 Digital Design for Computer Engineering	✓						✓		
TECH43030 Mechatronics		✓			✓			✓	
TECH47200 Systems Engineering									
TECH43220 Electric Machinery			✓						✓
TECH43031 Mechatronics II			✓			✓			✓

Summary of Program Assessment Plan

1. PROGRAM MISSION

The mission of the Mechatronics Engineering program is to provide a high quality undergraduate education in mechatronics engineering combining fundamental engineering abilities with the broad diversity of skills required to integrate the principles of mechanical, electrical, computer, and control engineering in the design and realization of complex machines.

2. STUDENT LEARNING OUTCOMES:

Student Learning Outcome 1: an ability to apply knowledge of mathematics, science, and engineering.

Method of Assessment: This learning outcome is assessed in required course TECH43220 Electric Machinery. Students apply knowledge of electromagnetism, complex algebra, and phasor diagrams to the solution of transformer and three-phase induction machine problems.

Achievement Target: Students should demonstrate conceptual and practical competence by the end of the course. A minimum 70 percent of the students must earn a B grade or better in the course for the learning objective to be met.

Method of Assessment: This learning outcome is assessed in required course TECH43031 Mechatronics II. Students utilize their knowledge of mechanical, electrical, computer, and control engineering to design and construct a mechatronic project.

Achievement Target: Students should demonstrate conceptual and practical competence by the end of the course. A minimum 70 percent of the students must earn a B grade or better in the course for the learning objective to be met.

Student Learning Outcome 2: an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

Method of Assessment: This learning outcome is assessed in required course TECH43580 Computer-Aided Machine Design. Students design shafts, bearings, gears, springs, fasteners, clutches, and brakes to meet design criteria.

Achievement Target: Students should demonstrate conceptual and practical competence by the end of the course. A minimum 70 percent of the students must earn a B grade or better in the course for the learning objective to be met.

Method of Assessment: This learning outcome is assessed in required course TECH43031 Mechatronics II. Students utilize their knowledge of mechanical, electrical, computer, and control engineering to design and construct a mechatronic project.

Achievement Target: Students should demonstrate conceptual and practical competence by the end of the course. A minimum 70 percent of the students must earn a B grade or better in the course for the learning objective to be met.

Student Learning Outcome 3: an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Method of Assessment: This learning outcome is assessed in required course TECH43220 Electric Machinery. Students apply knowledge of electromagnetism, complex algebra, and phasor diagrams to the solution of transformer and three-phase induction machine problems.

Achievement Target: Students should demonstrate conceptual and practical competence by the end of the course. A minimum 70 percent of the students must earn a B grade or better in the course for the learning objective to be met.

Method of Assessment: This learning outcome is assessed in required course TECH43031 Mechatronics II. Students utilize their knowledge of mechanical, electrical, computer, and control engineering to design and construct a mechatronic project.

Achievement Target: Students should demonstrate conceptual and practical competence by the end of the course. A minimum 70 percent of the students must earn a B grade or better in the course for the learning objective to be met.

3. ASSESSMENT RESULTS:
Describe how assessment results will be used for future program improvement (how and by whom results are reviewed and analyzed and how resulting plan of action will be implemented).

Assessment on these three learning outcomes will be conducted biennially. Results will be presented to the faculty, the appropriate industrial advisory boards, the program director, and the dean. Faculty will use the results to guide curricular development.