

THE UNIVERSITY OF NORTH CAROLINA AT ASHEVILLE
FACULTY SENATE

Senate Document Number 4819S
Date of Senate Approval 04/04/19

Statement of Faculty Senate Action:

APC Document 41 (ENGR): Application for Exception of the UNCA Credit Cap Policy

February 18, 2019

To: UNC Asheville's Academic Policies Committee

This document includes three petitions for exemption to curriculum limits for the Joint NCSU – UNC Asheville Bachelor of Science in Engineering (BSE) – Concentration in Mechatronics.

Petition for an Exemption to Exceed the 120 credit limit on BSE - Mechatronics

UNC Asheville requests an exemption to the 120 credit hour cap for its Joint Bachelor of Science in Engineering – Concentration in Mechatronics. This major requires students to complete 128 credit hours to obtain their degree as detailed below.

- 71 credit hours required for the Mechatronics Major
 - E 101 - Introduction to Engineering and Problem Solving (1)
 - ECE 109 - Introduction to Computer Systems (3)
 - ECE 200 - Introduction to Signals, Circuits and Systems (4)
 - ECE 209 - Computer Systems Programming (3)
 - ECE 211 - Electric Circuits (4)
 - ECE 212 - Fundamentals of Logic Design (3)
 - ECE 220 - Analytical Foundations of Electrical and Computer Engineering (3)
 - ECE 306 - Introduction to Embedded Systems (3)
 - ECE 310 - Design of Complex Digital Systems (3)
 - JEM 123 - Introduction to Computer Aided Design for Mechatronics Engineering (1)
 - JEM 180 - Introduction to Mechatronics Laboratory (2)
 - JEM 360 - Advanced Mechatronic Design Laboratory (2)
 - JEM 420 - Mechatronics Systems Modeling (3)
 - JEM 484 - Senior Design Project in Mechatronics Engineering I (3)
 - JEM 485 - Senior Design Project in Mechatronics Engineering II (3)
 - MAE 201 - Engineering Thermodynamics I (3)
 - MAE 206 - Engineering Statics (3)
 - MAE 208 - Engineering Dynamics (3)
 - MAE 214 - Solid Mechanics (3)
 - MAE 308 - Fluid Mechanics (3)
 - MAE 310 - Heat Transfer Fundamentals (3)

- MAE 315 - Dynamics of Machines (3)
- MAE 316 - Strength of Mechanical Components (3)
- MAE 435 - Principles of Automatic Control (3)

- One advisor-approved course from:
 - JEM 455 – Robotics and Autonomous Systems (3)
 - MSE 201 - Structure and Properties of Engineering Materials (3)

- 31 credit hours of required correlate courses
 - CHEM 111 - General Chemistry Laboratory (1)
 - CHEM 132 - General Chemistry (3)
 - ECON 102 - Principles of Microeconomics (3)
 - MATH 191 - Calculus I (4)
 - MATH 192 - Calculus II (4)
 - MATH 291 - Calculus III (4)
 - PHYS 221 - Physics I (4)
 - PHYS 222 - Physics II (4)
 - STAT 225 - Introduction to Calculus-Based Statistics (4)

Note: The following Liberal Arts Core requirements are satisfied by correlate courses:

- (4) Lab Science, PHYS 221 - Calculus-Based Physics;
- (3) Scientific Perspectives, CHEM 132 - General Chemistry
- (4) Mathematics Requirement, MATH 191 - Calculus
- (3) Social Science Requirement, ECON 102 - Principles of Microeconomics

- 26-37 additional credit hours are required for the Liberal Arts Core.
 - LA 178 - First-Year Seminar (3)
 - LANG 120 - Academic Writing and Critical Inquiry (4)
 - HUM 124, 214, 324 - A sequence of 3 courses devoted to the intellectual and cultural history of human civilization, including both Western and non-Western cultures (12)
 - ARTS Requirement (3)
 - Senior Capstone, HUM 414 or LA 478 (4)
 - Diversity Intensive (0-3) Students expected to take a DI ARTS course, so no additional hours required
 - Second Language (0-8) – Students expected to test out, so no additional hours required (NCSU requirement is satisfied by two years of the same high school foreign language with a grade of C- or better)

Relevant Program History

The Joint BSE–Mechatronics degree was originally created and accredited by the Accreditation Board for Engineering and Technology (ABET) as an NC State [2+2] degree that was offered exclusively on the campus of UNC Asheville. The 2+2 version of the Mechatronics degree was decommissioned by ABET in the spring of 2011. During that same accreditation cycle, ABET accredited the current version of the Mechatronics BSE as a truly joint degree; students now graduate simultaneously from UNC Asheville and North Carolina State University (NCSU) and receive a single joint diploma.

During their site visit, the ABET accreditation team recognized the unique nature and value associated with the UNC Asheville/NCSU joint effort, which was and remains a collaboration between two very different institutions within the UNC System: North Carolina's designated liberal arts university, UNC Asheville, and its flagship land grant university, NCSU.

Rationale for a 120 Credit Hour Cap Exception

Unlike in Europe and Japan, where mechatronics engineering is firmly established and recognized as an important area of engineering, mechatronics in the United States is in its infancy as a discipline. Of the 479 four-year engineering programs accredited by ABET, only five ABET accredited programs offer a bachelor of science degree in mechatronics engineering. We found the following Mechatronics programs and noted the accredited programs in the table below.

<u>Institution</u>	<u>ABET accredited</u>	<u>Credit Hours</u>
Kent State		120
Purdue University	*	120
Utah Valley		121
Cal University of Pennsylvania		123
Austin Peay University		123-124
Cal State University Channel Islands		125
UT Chattanooga		127
Middle Tennessee State University	*	128
NCSU-UNC Asheville	*	128
University of the Incarnate word		129
Kennesaw State University	*	129
Central Connecticut State University	*	130
Vaughn College		134

As can be seen from the credit hour requirements shown above, UNC Asheville’s Mechatronics BSE program is within the norm for mechatronics engineering programs, especially so for accredited programs.

Engineering at the BS level is a professional degree program. The BSE melds three disciplines of engineering: mechanical, electrical and computer. UNC Asheville and NCSU’s joint Mechatronics Program is designed to prepare students to pass professional licensing exams in one of these areas. These discipline-specific exams reflect basic body-of-knowledge requirements for each engineering discipline. We believe that while we must prepare our students for those exams, at the same time we must not short-change the humanities and social sciences. Our corporate

partners, graduate schools, and the ABET accrediting body, as well as the requirements of UNC Asheville and NCSU specify a need to produce graduates with skills complementary to their technical skills: effective oral and written communication, user-centered design, critical and creative thinking, and the ability to work in teams. Eroding hours in the humanities and social sciences negatively impacts our students' marketability as well as their higher education experience.

Because the Mechatronics Program is a professional engineering program, we believe it is not possible to deliver this program within the UNC system cap of 120 credit hours. The mechatronics engineers that graduate from the joint UNC Asheville / NCSU program are uniquely qualified through their strong engineering *and* liberal arts curricula. The program has already shrunk from 132 hours to 128 hours. We will continue to work with administrators at both universities to keep the program's credit hours in line with credit hour requirements for Mechatronics degrees at other institutions and for other engineering programs offered by NC State University.

Petition for an Exemption to Exceed the 45 credit limit on required hours in the Major

UNC Asheville currently has a 45 credit limit on required hours in the major. The BSE - Mechatronics curriculum currently requires 71 credits in the major. This is not unusual among the engineering majors at NC State where many require 60-70 credits in the major. Beyond the elements of professional engineering preparation, the field of mechatronics is multidisciplinary in nature. It blends electrical, mechanical and computer engineering for the precision control of electromechanical systems. It requires foundation courses in all three fields to enable students to complete 300- and 400-level courses in those fields as well as the senior capstone design project. Therefore, this petition for an exemption to exceed the 45 credit limit on required hours in the major is submitted for approval.

Petition for an Exemption to Exceed the 100 credit limit on Major plus LAC hours

As stated in the first petition, the mechatronics curriculum currently requires 71 credits in the major and 31 hours for correlate courses. The requirement for 31 hours of correlate classes is well above average at UNC Asheville and is related to the technical nature of the curriculum. While a total number of hours at 128 is well above the 100 credit limit, it should be noted that 14 hours of the correlate courses also satisfy LAC requirements:

- Lab Science, PHYS 221 - Calculus-Based Physics;
- Scientific Perspectives, CHEM 132 - General Chemistry
- Mathematics Requirement, MATH 191 - Calculus
- Social Science Requirement, ECON 102 - Principles of Microeconomics

It can be argued that if the number of LAC satisfied hours (14) is subtracted from the curriculum total of 128, the adjusted total for your consideration is actually 114 hours. This petition for an exemption to exceed the 100 credit limit on major plus LAC hours is submitted for approval.