MEMORANDUM OF UNDERSTANDING
CARROLL COMMUNITY COLLEGE & TOWSON UNIVERSITY
November 18, 2019

PHYSICS B.S. Degree

Carroll Community College, Westminster, Maryland, and Towson University, agree to follow the articulation of courses outlined in the articulation (course equivalency) document, for completion of requirements for the Bachelor of Science degree in Physics - General Physics concentration (Attachment A), which is attached to, and incorporated by reference into, this Memorandum of Understanding (MOU). The following principles guide the operation of this MOU, with the requirements for transfer in specific curricula set forth in Attachment A.

1. Towson University will accept a maximum number of 64 credits from Carroll Community College as outlined in the Attachment A. The number of transferable credits specific to this program is reflected in Attachment A.

2. Students who have completed the Associate of Science Degree in Physical Sciences, Physics Concentration program at Carroll Community College may transfer into Towson University's Physics program with junior standing provided that the student has completed all courses identified on Attachment A (which is attached to, and incorporated by reference into, this MOU) with a cumulative GPA of 2.00 or higher. Courses completed at Carroll Community College with 300 or 400 level Towson University course equivalencies will transfer as lower-level credit but will satisfy course content as indicated.

3. Only courses in which a grade of C (2.00) or better is earned will apply toward the major at Towson University.

4. In accordance with the MHEC transfer policy pertaining to general education requirements, Towson University will accept the completion of Carroll Community College's general education requirements (GenEds) and students will be required to complete courses at Towson University to satisfy the remaining ***University Core*** requirements as shown in Attachment A.

5. Towson University recognizes college-level experiential learning gained through previous work, military and/or volunteer service or life experience. Credit for prior learning may also be established through course challenge or standardized credit by examination.

6. Carroll Community College students transferring to Towson University will be given every consideration for financial aid and will be eligible to compete for academic scholarships upon entrance to Towson University subject to stated scholarship deadlines.

7. Both Carroll Community College and Towson University agree to work together to facilitate the transfer of students from Carroll Community College to Towson University to work cooperatively to insure the high quality of the programs at the respective institutions. Transfer of students will be in accordance with policies and procedures of both institutions, as they may be amended from time to time.

8. This MOU will be in effect initially for ten years, beginning ***fall 2019***, with a review every two years by both parties. Any revisions the parties deem necessary must be evidenced in writing and signed by the authorized officials of each institution. The MOU may be terminated by either party for due cause and after adequate notice of not less than six months is given to the other party.

9. Towson University will establish procedures to provide information on the academic progress of Carroll Community College students enrolled as part of this MOU.

10. This MOU, when signed, constitutes the entire agreement between the parties and supersedes all prior agreements and understandings between the parties respecting the matter hereof.

CARROLL COMMUNITY COLLEGE AND TOWSON UNIVERSITY

Dr. Rosalie Mince
Vice President of
Academic and Student Affairs

Date 11/22/19

Dr. Melanie Perreault
Provost and Executive Vice-President
for Academic Affairs

Date 12/10/19

2+2 Articulation Agreement for Carroll Community College and Towson University

Associate's Degree: A.S. in Physical Sciences, Physics Concentration
Bachelor's Degree: B.S. in Physics, General Physics Concentration
Effective Term: Fall 2019

Choosing the Right Physics Pathway

The following information will guide students in selecting the best 2+2 pathway for their career and education goals:

Students intending to pursue graduate studies in physics or astrophysics should follow the pathway for either the General Physics or Astrophysics concentration. The pathway for the Applied Physics concentration is recommended for students who plan to pursue fundamental or applied research and development in industrial or government laboratories. The Computational Physics Concentration is designed to provide students with strong scientific, technical and computational skills necessary for employment in a STEM profession; it is not recommended if students wish to pursue graduate studies in physics.

Section 1: Course Completion Plan for Carroll Community College

This section outlines the courses to take for the Carroll Community College general education and program requirements in order to complete both Carroll Community College and TU degrees within a total of 4 years and 120 credits. The following tables do not include any nontransferable or prerequisite coursework outside of the curriculum.

Table 1: General Education Courses Applied to TU Core Curriculum

Carroll CC Requirement	Carroll CC Course to Take	Credit	Towson University Equivalent Course
English Composition	ENGL 101 College Writing	3	ENGL 102 Writing for a Liberal Education
Mathematics	MATH 135 Calculus of a Single Variable I	4	MATH 273 Calculus I
Arts & Humanities	Any Arts & Humanities course	3	Equivalency will vary by course.
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Social & Behavioral Sciences	Any Social & Behavioral Sciences course	3	Equivalency will vary by course.
Social & Behavioral Sciences	Any Social & Behavioral Sciences course	3	Equivalency will vary by course.
Biological & Physical Sciences	CHEM 105 Principles of General Chemistry I	4	CHEM 131 & 131L General Chemistry I Lecture & Lab
Biological & Physical Sciences	PHYS 111 Physics I for Scientists & Engineers	4	PHYS 241 General Physics I Calculus-Based
General Education Elective	PHYS 212 Physics II for Scientists & Engineers	4	PHYS 242 General Physics II Calculus-Based
English Literature	ENGL 102 Writing about Literature	3	ENGL TLL English Elective

Total general education applied to the TU Core Curriculum: 34 credits

Completing the courses in Table 1 will satisfy the general education program at Carroll CC. Upon transferring to TU, students will receive a core package that satisfies most of the TU Core Curriculum without the need for course-by-course placement in specific Core Curriculum requirements. Students will only need to complete two Core Curriculum requirements at TU: Advanced Writing Seminar (Core 9) and Ethical Perspectives (Core 14). If an ethics course is taken as one of the Arts & Humanities requirements at Carroll CC, students will complete a different requirement than Core 14.

Table 2: Program Requirements and Electives Applied to TU Degree

Carroll CC Requirement	Carroll CC Course to Take	Credit	Towson University Equivalent Course
Concentration Requirement	MATH 136 Calculus of a Single Variable II	4	MATH 274 Calculus II
Concentration Requirement	MATH 205 Multivariable Calculus	4	MATH 275 Calculus III
Concentration Requirement	MATH 215 Differential Equations	4	MATH T74 Differential Equations
Concentration Requirement	CHEM 106 Principles of General Chemistry II	4	CHEM 132 & 132L General Chemistry II Lecture & Lab
Concentration Requirement	PHYS 213 Physics III for Scientists & Engineers	4	PHYS 243 General Physics III
Program Elective	MATH 210 Linear Algebra	4	MATH 265 Elementary Linear Algebra
Program Elective	Any elective course	2	Equivalency will vary by course

Total program requirements applied to the TU degree: 26 credits
Total transferred to TU: 60 credits

Students may transfer a maximum of 64 credits. If students do not adhere to the courses outlined above in Tables 1 and 2, they are not guaranteed completion of the bachelor's degree in 2 years. Refer to section 2 for specific course details and transfer planning information.

Section 2: Carroll Community College Course Selection Details

This section explains any specific course selections made in section 1 and provides transfer information specific to this degree plan. Students will complete all non-physics courses required for the TU Physics major at Carroll CC. If students do not complete the courses outlined in this agreement, they will be required to complete outstanding requirements at TU.

GENERAL EDUCATION

Students should be aware of the following information when completing their general education requirements:

- It is recommended that all students complete both a mathematics and English course within their first 12 credit hours.
- **General Education Mathematics:** MATH 135 satisfies a required course for the major at TU (MATH 273). Students who must take pre-calculus may end up taking more than 60 credits for the associate degree.
- **General Education Biological and Physical Science:** CHEM 105 satisfies the non-physics requirement for the General Physics concentration at TU (CHEM 131 & 131L). PHYS 111 satisfies required course for the major at TU (PHYS 241).
- **General Education Elective:** PHYS 212 satisfies a required course for the major at TU (PHYS 242).
- **ENGL 102** satisfies both the English Composition and Diversity requirements at Carroll CC.
- Students should select courses that appeal to their personal or professional interests to satisfy **Arts and Humanities** and **Social & Behavioral Science** requirements. All courses that satisfy these general education categories at Carroll will transfer and apply to TU's Core Curriculum. Courses for which TU does not have a direct equivalency will be assigned a lower level elective in the same discipline (e.g. COMM TLL).

PROGRAM REQUIREMENTS

The following courses will satisfy required courses in the major at TU:

- **Program Requirement:** MATH 136 satisfies a required course for the major at TU (MATH 274).
- **Program Requirement:** MATH 205 satisfies a non-physics requirement for the general physics concentration at TU (MATH 275). This course is only offered at Carroll in the fall term.
- **Program Requirement:** MATH 215 satisfies a non-physics requirement for the general physics concentration at TU (MATH 374). This course is only offered at Carroll in the spring term and transfers to TU as MATH T74, a lower-level equivalent of MATH 374.
- **Program Requirement:** CHEM 106 satisfies a non-physics requirement for the general physics concentration at TU (CHEM 132 & 132L).
- **Program Requirement:** PHYS 213 satisfies a required course for the major at TU (PHYS 243).

PROGRAM ELECTIVES

Students must note the following information about their program electives:

- **MATH 210 Linear Algebra** is recommended as preparation for upper-level courses in the major at TU.
- The remaining program electives may be satisfied by a course of the student's choosing.

LOWER-LEVEL EQUIVALENTS OF UPPER-LEVEL COURSES

A course number beginning with T indicates that a course transfers as a lower-level equivalent of an upper-level TU course. MATH T74 will satisfy a major requirement but will not count toward the TU degree requirement for 32 upper-level units.

Section 3: Degree Requirements to Be Completed at TU

This section outlines the remaining degree requirements for students transferring into the General Physics concentration of the Physics major. Refer to section 4 for university-wide degree requirements.

CORE CURRICULUM REQUIREMENTS: 6 UNITS

Core 9 Advanced Writing Seminar
Core 14 Ethical Issues and Perspectives

REQUIRED PHYSICS COURSES FOR ALL PHYSICS MAJORS: 22 UNITS

PHYS 185 Introductory Honors Seminar in Physics (1 unit)
PHYS 270 Computers in Physics (4 units)
PHYS 307 Introductory Mathematical Physics (3 units)
PHYS 311 Modern Physics I (3 units)
PHYS 341 Intermediate Physics Laboratory I (3 units)
PHYS 351 Mechanics (4 units)
PHYS 354 Electricity & Magnetism (4 units)

GENERAL PHYSICS CONCENTRATION – ADVANCED PHYSICS COURSES: 23 UNITS

PHYS 312 Modern Physics II (3 units)
PHYS 342 Intermediate Physics Laboratory II (3 units)
PHYS 352 Thermodynamics and Kinetic Theory (3 units)
PHYS 385 Physics Seminar (1 unit)
PHYS 455 Introductory Quantum Mechanics (3 units)
PHYS 486 Physics Seminar II (1 unit)
Upper Level PHYS or ASTR Electives (9 units)

GENERAL ELECTIVES: 9 UNITS

The total number of electives required is determined by subtracting the total units completed for the major and Core Curriculum from 120 units. General elective units can be satisfied by additional major electives or courses for personal interest.

Section 4: Additional Requirements for TU Degree Completion

BACHELOR'S DEGREE REQUIREMENTS FOR ALL STUDENTS:

- A C (2.0) or higher is required in all major courses and prerequisites.
- A cumulative grade point average (GPA) of 2.0 is required.
- 32 units of the bachelor's degree must be completed at the upper level (courses numbered 300 or above).

Degree Completion Summary

TOTAL UNITS REQUIRED FOR B.S. DEGREE	120 UNITS
Carroll Community College A.S. Degree in Physical Sciences – Physics Concentration	60
Completion of Core Curriculum at TU	6
Major in Physics – General Physics Concentration Coursework at TU	45
General Electives Taken at TU	9