MATH AND PHYSICS

Department website (https://www.uwp.edu/learn/departments/mathandphysics/)

College: College of Natural & Health Sciences

Professional Accreditations or Memberships:

American Mathematical Society

Student Organizations/Clubs:

Math Club; Pi Mu Epsilon (Wisconsin Gamma Chapter); Society of Physics Students

Career Possibilities for Mathematics Majors:

The future outlook for careers in mathematics remains promising, especially for those who combine their training with other specialties. A degree with a major in mathematics with supporting work in computer science, business or economics will increase employment opportunities.

Department Overview

The Mathematics and Physics Department offers a rigorous and well-balanced program of courses leading to a bachelor of science degree with majors in mathematics and physics. Mathematics is of central importance in the sciences. In fact, mathematics has been called the language of science. This applies not only to the physical and biological sciences but increasingly to the social, managerial and behavioral sciences as well. Much of mathematics has been developed to meet the needs of the areas of human knowledge that it serves. In addition to its service role in other areas, mathematics occupies a place of its own in our intellectual heritage. From ancient Greece to our own times, people have been drawn to the elegant structure.

The physics major is primarily intended for students who wish to pursue graduate work in physics or related areas, careers in higher education, or careers in technology-based industry.

The mathematics and physics faculty are active in research. Current areas of research interest include astrophysics, computational physics, condensed matter theory, many-body theory, mathematical physics, quantum field theory, and statistical mechanics. Students majoring in mathematics or physics have an excellent opportunity to get involved in ongoing research projects. In the recent past, students have appeared as co-authors on a number of scientific publications in research and teaching journals.

In addition to mathematics and physics majors, the department hosts an articulated pre-engineering/engineering program with the University of Wisconsin-Milwaukee.

Program Level Outcomes for Mathematics

1. Formulate and prove mathematical results in the language of mathematics.
2. Perform technical mathematical computations in mathematics and related fields.
3. Translate ideas and meanings from the language of everyday life (English) into mathematical language (formulas and symbols).
4. Communicate in the language of mathematics.
5. Search for knowledge in independent and responsible ways.

High School Preparation

Students entering a degree program at UW-Parkside should have taken at least three years of high school mathematics including ninth-grade algebra, 10th-grade geometry and 11th-grade advanced algebra and trigonometry. Students intending to take college-level mathematics courses are encouraged to strengthen their preparation by taking 12th-grade pre-calculus.

Computational Skills Requirement

Students satisfy this requirement with the completion of either MATH 102 Quantitative Reasoning or MATH 103 Elementary Statistics for 3 credits or MATH 111 College Algebra I for 4 credits (with a grade of C-minus or better).

Students are exempt from the requirement if their placement results (based on UW Mathematics Placement Test) are above MATH 102 Quantitative Reasoning or MATH 111 College Algebra I. Students must complete computational skills within their first 60 academic credits.

Placement Examination

Mathematics Placement is by UW Mathematics Placement Test scores. This examination serves as a guide for placement in mathematics courses. Placement in mathematics courses is usually made at the following levels:

1. MATH 102 Quantitative Reasoning, MATH 103 Elementary Statistics, MATH 104 College Mathematics with Applications or MATH 111 College Algebra I – students with fewer than three years of high school math, or inadequate background, or who have been out of school for an extended period of time.
2. MATH 112 College Algebra II, MATH 113 Trigonometry or MATH 114 College Algebra II/Trigonometry – students with three years of high school mathematics.
3. MATH 221 Calculus and Analytic Geometry I – students with four years of high school mathematics.

Math Bridge is a required four-week math program for new and continuing students who could benefit from additional math support. It is designed to help students build confidence and mathematical skill.

Program Level Outcomes for Physics

1. Student should be scientifically literate in the foundations of physics, both theoretical and practical.
2. Students should be able to take data in a lab environment or computer simulation, analyze it, present it coherently in a written format and draw from the analysis a convincing conclusion based upon the principles of the scientific method.
3. Students will master the tools of modern physics; mathematical, computational, and experimental.
4. The student should be able to orally present in a professional, lucid manner, the results and analysis of an experiment or research and effectively answer questions on the topic of their work in a scientific seminar format.
5. The student is expected to have mastered the methods of modern scientific exploration at an appropriate level, and engage in a continual self-examination for any deficiencies, and take advantage

of opportunities to rectify them. The goal is to be fully prepared for the Physics GRE exam.

Articulation Agreement UW-Milwaukee Engineering Program

The articulated pre-engineering/engineering agreement with University of Wisconsin-Milwaukee (UWM) creates a curriculum plan so the students at the University of Wisconsin-Parkside (UWP) may complete and transfer coursework applicable to the first two years of the UWM biomedical, civil, electrical, industrial and manufacturing, mechanical and materials engineering majors in the College of Engineering and Applied Science (CEAS), and provides guaranteed transfer to students who complete all of the articulated pre-engineering courses and the UWM admission requirements. Students complete 80-85 credits, and may earn the Associate of Science degree in Physics at UWP. Specific associate degree requirements are in the Associate Degree section of the catalog.

Admission Requirements and the Highlights of the Program

- Students complete the first two years of course work (78-86 credits) at UW-Parkside, then continue at UWM toward one of the majors in UWM CEAS - biomedical, civil, electrical, industrial and manufacturing, mechanical and materials engineering in the College of Engineering and Applied Science (CEAS) with junior standing.

- The transfer with junior standing is guaranteed for students who complete all of the articulated courses within the UWP-UWM agreement with a cumulative GPA no less than the minimum GPA for the individual UWM major to which the student seeks admission.

- All UWP university admission requirements apply. Admission into the UWP-UWM articulated engineering requires placement into MATH 221 Calculus and Analytic Geometry I or successful completion of the pre-requisites for MATH 221 Calculus and Analytic Geometry I.

- During the first 78-86 credits of study (the first two years), students will be primarily advised by UWP faculty but will also have a co-advisor from UWM to facilitate smooth transition to UWM CEAS.

- Students will pay tuition and appropriate fees to the university at which they are enrolled.

- Students admitted under this agreement will be guided by UWM and UWP catalog year of their admission to UWP.

- Students who voluntarily withdraw or do not meet the requirement to continue in the program, may transfer any of their earned UWP/UWM credits into another degree program subject to the credit transfer equivalencies and requirements.

UW-Parkside Associate of Science in Physics / UW-Milwaukee Bachelor of Science Electrical Engineering Agreement 4-Year Plan

Course	Title	Credits
Year 1		
Fall Semester		
UW-Parkside - Electrical Engineering Program		
MATH 221	Calculus and Analytic Geometry I	5
PHYS 201	General Physics I	5
CHEM 101 & CHEM 103	General Chemistry I and General Chemistry Lab I	5
ENGL 101	Composition and Reading	3
	Credits	**18**
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Spring Semester		
MATH 222	Calculus and Analytic Geometry II	5
PHYS 202	General Physics II	5
PHYS 241	Scientific Programming [1]	3
Gen Ed	Social/Behavioral Sciences	3
	Credits	**16**
Summer Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Year 2		
Fall Semester		
UW-Parkside - Electrical Engineering Program		
MATH 223	Calculus and Analytic Geometry III	5
MATH 317	Differential Equations and their Applications [2]	4
PHYS 302	Electricity and Magnetism [3]	4
ENGL 167	Introduction to Literature (HU)	3
	Credits	**16**
Winterim Semester		
Gen Ed	Humanities/Arts	3
	Credits	**3**
Spring Semester		
PENG 214	Electrical Circuits I [4]	3
PHYS 403	Thermodynamics [5]	3
Gen Ed	Humanities/Arts	3
Gen Ed	Social/Behavioral Sciences	3
ENGL 201	Advanced Composition	3
	Credits	**15**
Summer Semester		
COMM 105	Public Speaking for the 21st Century	3
	Credits	**3**
Year 3		
Fall Semester		
UWM Electrical Engineering		
EAS 200	Professional Seminar	1
ELEC ENG 305	Electrical Circuits II	4
ELEC ENG 310	Signals and Systems	3
ELEC ENG 330	Electronics I	4
ELEC ENG 354	Digital Logic	3
COMP SCI 241	C Programming for Embedded Systems	3
	Credits	**18**
Spring Semester		
ELEC ENG 335	Electronics II	4
ELEC ENG 362	Electromechanical Energy Conversion	4
ELEC ENG 367	Introduction to Microprocessors	4
Technical Elective		6
	Credits	**18**
Year 4		
Fall Semester		
UWM Electrical Engineering		
ELEC ENG 420	Random Signals & Systems	3
3-Approved Technical Electives		9
MATL 201	Engineering Materials	4
	Credits	**16**
Spring Semester		
ELEC ENG 595	Capstone Senior Design project	4

4-Approved Technical Electives		12
	Credits	16
	Total Credits	145

[1] CompSci 240-UWM
[2] ELEC ENG 234-UWM
[3] ELEC ENG 361-UWM
[4] ELEC ENG 301-UWM
[5] MECH ENG 301-UWM

Year 1

Humanities/Arts – 0/12 completed; Social/Behavioral Sciences – 9/12 completed; Natural Science 15/12 completed; Total Credits – 40 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – not complete

Year 2

Humanities/Arts – 12/12 completed; Social/Behavioral Sciences – 12/12 completed; Natural Science 15/12 completed; Total Credits – 78 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – complete.

Foreign Language may be required depending on individual student's backgrounds. Please check UW-Milwaukee requirements.

Note: Students should utilize TIS to determine general education courses that transfer to UWM and meet UWM general education requirements. One of the Humanities/Arts or Social/Behavioral Sciences courses need to also meet Diversity requirement. Computational skills requirement is fulfilled with MATH 111 College Algebra I. Prepared using UW-Parkside's 2017-2019 catalog. UW-Parkside courses specific for the engineering program have prefix PENG.

UW-Parkside Associate of Science in Physics / UW-Milwaukee Bachelor of Science Mechanical Engineering Agreement 4-Year Plan

Course	Title	Credits
Year 1		
Fall Semester		
UW-Parkside - Mechanical Engineering Program		
MATH 221	Calculus and Analytic Geometry I	5
PHYS 201	General Physics I	5
CHEM 101 & CHEM 103	General Chemistry I and General Chemistry Lab I	5
ENGL 101	Composition and Reading	3
	Credits	18
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	3
Spring Semester		
MATH 222	Calculus and Analytic Geometry II	5
PHYS 202	General Physics II	5
PHYS 241	Scientific Programming [1]	3
PENG 211	Statics [2]	3
	Credits	16
Summer Semester		
Gen Ed	Social/Behavioral Sciences	3

Course	Title	Credits
Gen Ed	Humanities/Arts	3
	Credits	6
Year 2		
Fall Semester		
UW-Parkside - Mechanical Engineering Program		
MATH 223	Calculus and Analytic Geometry III	5
PENG 212	Dynamics [3]	3
ENGL 167	Introduction to Literature (HU)	3
MATH 317	Differential Equations and their Applications [4]	4
Gen Ed	Social/Behavioral Sciences	3
	Credits	18
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
COMM 105	Public Speaking for the 21st Century	3
	Credits	6
Spring Semester		
PHYS 403	Thermodynamics [5]	3
CHEM 102 & CHEM 104	General Chemistry II and General Chemistry Lab II	5
PENG 214	Electrical Circuits I [6]	3
ENGL 201	Advanced Composition	3
	Credits	14
Summer Semester		
Gen Ed	Humanities/Arts	3
	Credits	3
Year 3		
Fall Semester		
UWM Mechanical Engineering		
EAS 200	Professional Seminar	1
CIV ENG 303	Strength of Materials	4
MATL ENG 201	Engineering Materials	4
MECH ENG 110	Engineering Fundamentals I	4
MECH ENG 320	Introduction to Fluid Mechanics	3
	Credits	16
Spring Semester		
IND ENG 367	Introductory Statistics for Engineers	3
MATL ENG 330	Materials & Processes in Manufacturing	3
MECH ENG 111	Engineering Fundamentals II	4
MECH ENG 321	Basic Heat Transfer	4
MECH ENG 474	Introduction to Control Systems	4
	Credits	18
Year 4		
Fall Semester		
UWM Mechanical Engineering		
MECH ENG 323	Fluid Mechanics Laboratory	1
MECH ENG 360	Mechanical Design I	3
MECH ENG 366	Design of Machine Elements	4
MECH ENG 370	Comp Aided Engineer Lab	2
2-Approved Technical Electives		6
	Credits	16
Spring Semester		
MECH ENG 438	Mech Engineering Experimentation	3
MECH ENG 479	Mechatronics	3
MECH ENG 496	Senior Design Project	3
3-Approved Technical Electives		9
	Credits	18
	Total Credits	152

[1] MECH ENG 101-UWM
[2] CIV ENG 201-UWM
[3] CIV ENG 202-UWM

[4] ELEC ENG 234-UWM
[5] MECH ENG 301-UWM
[6] ELEC ENG 301-UWM

Year 1

Humanities/Arts – 3/12 completed; Social/Behavioral Sciences – 6/12 completed; Natural Science 15/12 completed; Total Credits – 43 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – not complete.

Year 2

Humanities/Arts – 12/12 completed; Social/Behavioral Sciences – 12/12 completed; Natural Science 15/12 completed; Total Credits – 85 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – complete.

Foreign Language may be required depending on individual student's backgrounds. Please check UW-Milwaukee requirements.

Note: Students should utilize TIS to determine general education courses that transfer to UWM and meet UWM general education requirements. One of the Humanities/Arts or Social/Behavioral Sciences courses need to also meet Diversity requirement. Computational skills requirement is fulfilled with MATH 111 College Algebra I. Prepared using UW-Parkside's 2017-2019 catalog. UW-Parkside courses specific for the engineering program have prefix PENG.

UW-Parkside Associate of Science in Physics / UW-Milwaukee Bachelor of Science Industrial & Manufacturing Engineering Agreement 4-Year Plan

Course	Title	Credits
Year 1		
Fall Semester		
UW-Parkside - Industrial and Manufacturing Engineering Program		
MATH 221	Calculus and Analytic Geometry I	5
PHYS 201	General Physics I	5
CHEM 101 & CHEM 103	General Chemistry I and General Chemistry Lab I	5
ENGL 101	Composition and Reading	3
	Credits	**18**
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Spring Semester		
MATH 222	Calculus and Analytic Geometry II	5
PHYS 202	General Physics II	5
PHYS 241	Scientific Programming [1]	3
PENG 211	Statics [2]	3
	Credits	**16**
Summer Semester		
Gen Ed	Humanities/Arts	3
Gen Ed	Humanities/Arts	3
	Credits	**6**
Year 2		
Fall Semester		
UW-Parkside - Industrial and Manufacturing Engineering Program		
COMM 105	Public Speaking for the 21st Century	3
ENGL 167	Introduction to Literature (HU)	3
MATH 223	Calculus and Analytic Geometry III	5
MATH 317	Differential Equations and their Applications [3]	4
PENG 212	Dynamics [4]	3
	Credits	**18**
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Spring Semester		
CHEM 102 & CHEM 104	General Chemistry II and General Chemistry Lab II	5
PHYS 403	Thermodynamics [5]	3
PENG 214	Electrical Circuits I [6]	3
ENGL 201	Advanced Composition	3
Gen Ed	Social/Behavioral Sciences	3
	Credits	**17**
Summer Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Year 3		
Fall Semester		
UWM Industrial and Manufacturing Engineering		
EAS 200	Professional Seminar	1
IND ENG 370	Introduction to Operations Analysis	3
IND ENG 455	Operations Research I	3
IND ENG 367	Intro Statistics for Engineers	3
MATL ENG 201	Engineering Materials	4
	Credits	**14**
Spring Semester		
IND ENG 111	Introduction to Engineering	3
IND ENG 112	Engineering Drawing & CAD/Drafting	3
IND ENG 465	Operations Research II	3
IND ENG 475	Intro to Simulation Methodology	3
IND ENG 571	Quality Control	3
	Credits	**15**
Year 4		
Fall Semester		
UWM Industrial and Manufacturing Engineering		
IND ENG 350	Manufacturing Processes	3
IND ENG 470	Methods Engineering	3
IND ENG 580	Ergonomics	3
IND ENG 583	Facility Layout & Mat Handling	3
Approved Technical Elective		3
	Credits	**15**
Spring Semester		
IND ENG 360	Engineering economic Analysis	3
IND ENG 575	Design of Experiments	3
IND ENG 485	Senior Design Project	3
IND ENG XXX	2 Approved Technical Electives	6
	Credits	**15**
	Total Credits	**143**

[1] CompSci 240-UWM
[2] CIV ENG 201-UWM
[3] ELEC ENG 234-UWM
[4] CIV ENG 202-UWM
[5] MECH ENG 301-UWM
[6] ELEC ENG 301-UWM

Year 1

Humanities/Arts – 6/12 completed; Social/Behavioral Sciences – 3/12 completed; Natural Science 15/12 completed; Total Credits – 43

completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – not complete.

Year 2

Humanities/Arts – 12/12 completed; Social/Behavioral Sciences – 12/12 completed; Natural Science 15/12 completed; Total Credits – 85 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – complete.

Foreign Language may be required depending on individual student's backgrounds. Please check UW-Milwaukee requirements.

Note: Students should utilize TIS to determine gen. ed. courses that transfer to UWM and meet UWM general education requirements. One of the Humanities/Arts or Social/Behavioral Sciences courses need to also meet Diversity requirement. Computational skills requirement is fulfilled with MATH 111 College Algebra I. Prepared using UW-Parkside's 2017-2019 catalog. UW-Parkside courses specific for the engineering program have prefix PENG.

UW-Parkside Associate of Science in Physics / UW-Milwaukee Bachelor of Science Biomedical Engineering Agreement 4-Year Plan

Course	Title	Credits
Year 1		
Fall Semester		
UW-Parkside - Biomedical Engineering Program		
MATH 221	Calculus and Analytic Geometry I	5
PHYS 201	General Physics I	5
CHEM 101 & CHEM 103	General Chemistry I and General Chemistry Lab I	5
ENGL 101	Composition and Reading	3
	Credits	**18**
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Spring Semester		
MATH 222	Calculus and Analytic Geometry II	5
PHYS 202	General Physics II	5
PHYS 241	Scientific Programming [1]	3
PENG 211	Statics [2]	3
	Credits	**16**
Summer Semester		
Gen Ed	Social/Behavioral Sciences	3
Gen Ed	Humanities/Arts	3
	Credits	**6**
Year 2		
Fall Semester		
UW-Parkside - Biomedical Engineering Program		
MATH 223	Calculus and Analytic Geometry III	5
PENG 212	Dynamics [3]	3
BIOS 105	Human Physiology and Anatomy I	5
MATH 317	Differential Equations and their Applications [4]	4
	Credits	**17**
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
COMM 105	Public Speaking for the 21st Century	3
	Credits	**6**

Spring Semester		
PENG 214	Electrical Circuits I [5]	3
PHYS 403	Thermodynamics [6]	3
BIOS 106	Human Physiology and Anatomy II	5
ENGL 201	Advanced Composition	3
ENGL 167	Introduction to Literature (HU)	3
	Credits	**17**
Summer Semester		
Gen Ed	Social Behavioral Sciences	3
Gen Ed	Humanities/Arts	3
	Credits	**6**
Year 3		
Fall Semester		
UWM Biomedical Engineering		
EAS 200	Professional Seminar	1
BME 101	Fundamental of Biomedical Engineering	3
ELEC ENG 305	Electrical Circuits II	4
BME 302	Analysis of Dynamic Systems	4
MATL ENG 201	Engineering Materials	4
	Credits	**16**
Spring Semester		
BME 320	Engineering of Biomedical Devices 1	4
BME 305	Engineering Biomechanics	3
IND ENG 367	Intro to Statistics for Engineers	3
ELEC ENG 310	Signals and Systems	3
	Credits	**13**
Year 4		
Fall Semester		
UWM Biomedical Engineering		
BME 325	Engineering of Biomed. Devices 2	3
BME 385	Introduction to Biomaterials	3
BME 495	Biomedical Instrumentation Lab/Senior Lab	3
2-Technical Elective		6
	Credits	**15**
Spring Semester		
BME 595	Capstone Design Project	4
2-Technical Elective		6
	Credits	**10**
	Total Credits	**143**

[1] MECH ENG 101-UWM
[2] CIV ENG 201-UWM
[3] CIV ENG 202-UWM
[4] ELEC ENG 234-UWM
[5] ELEC ENG 301-UWM
[6] MECH ENG 301-UWM

Year 1

Humanities/Arts – 3/12 completed; Social/Behavioral Sciences – 6/12 completed; Natural Science 15/12 completed; Total Credits – 43 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – not complete.

Year 2

Humanities/Arts – 12/12 completed; Social/Behavioral Sciences – 12/12 completed; Natural Science 15/12 completed; Total Credits – 90 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – complete.

Foreign Language may be required depending on individual student's backgrounds. Please check UW-Milwaukee requirements.

Note: Students should utilize TIS to determine general education courses that transfer to UWM and meet UWM general education requirements. One of the Humanities/Arts or Social/Behavioral Sciences courses need to also meet Diversity requirement. Computational skills requirement is fulfilled with MATH 111 College Algebra I. Prepared using UW-Parkside's 2017-2019 catalog. UW-Parkside courses specific for the engineering program have prefix PENG.

UW-Parkside Associate of Science in Physics / UW-Milwaukee Bachelor of Science Civil Engineering Agreement 4-Year Plan

Course	Title	Credits
Year 1		
Fall Semester		
UW-Parkside - Civil Engineering Program		
MATH 221	Calculus and Analytic Geometry I	5
PHYS 201	General Physics I	5
CHEM 101 & CHEM 103	General Chemistry I and General Chemistry Lab I	5
ENGL 101	Composition and Reading	3
	Credits	**18**
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Spring Semester		
MATH 222	Calculus and Analytic Geometry II	5
PHYS 202	General Physics II	5
Gen Ed	Social/Behavioral Sciences	3
PENG 211	Statics [1]	3
	Credits	**16**
Summer Semester		
Gen Ed	Humanities/Arts	3
	Credits	**3**
Year 2		
Fall Semester		
UW-Parkside - Civil Engineering Program		
COMM 105	Public Speaking for the 21st Century	3
ENGL 167	Introduction to Literature (HU)	3
MATH 223	Calculus and Analytic Geometry III	5
MATH 317	Differential Equations and their Applications [2]	4
PENG 212	Dynamics [3]	3
	Credits	**18**
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Spring Semester		
PENG 216	Engineering Drawing and Computer Aided Design [4]	3
PHYS 403	Thermodynamics [5]	3
CHEM 102 & CHEM 104	General Chemistry II and General Chemistry Lab II	5
ENGL 201	Advanced Composition	3
Gen Ed	Humanities/Arts	3
	Credits	**17**
Summer Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**

Course	Title	Credits
Year 3		
Fall Semester		
UWM Civil Engineering		
EAS 200	Professional Seminar	1
CIV ENG 280	Computer Based Engineering Analysis	3
CIV ENG 303	Strength of Materials	4
IND ENG 111	Introduction to Engineering	3
MECH ENG 320	Introduction to Fluid Mechanics	3
	Credits	**14**
Spring Semester		
CIV ENG 250	Surveying for Construction	3
CIV ENG 372	Introduction to Structural Design	4
CIV ENG 411	Water Resources Design	3
CIV ENG 490	Transportation Engineering	3
Natural Science Elective		5
	Credits	**18**
Year 4		
Fall Semester		
UWM Civil Engineering		
CIV ENG 335	Soil Mechanics	3
CIV ENG 413	Environmental Engineering	3
CIV ENG 494	Principles of CE Design	1
2 Approved Technical Electives		6
MATL ENG 201	Engineering Materials	4
	Credits	**17**
Spring Semester		
CIV ENG 495	Senior Design	3
4-Approved Technical Electives		12
IND ENG 360	Engineering Economic Analysis	3
	Credits	**18**
	Total Credits	**148**

[1] CIV ENG 201-UWM
[2] ELEC ENG 234-UWM
[3] CIV ENG 202-UWM
[4] IND ENG 112-UWM
[5] MECH ENG 301-UWM

Year 1

Humanities/Arts – 3/12 completed; Social/Behavioral Sciences – 6/12 completed; Natural Science 15/12 completed; Total Credits – 43 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – not complete.

Year 2

Humanities/Arts – 12/12 completed; Social/Behavioral Sciences – 12/12 completed; Natural Science 15/12 completed; Total Credits – 85 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – complete.

Foreign Language may be required depending on individual student's backgrounds. Please check UW-Milwaukee requirements.

Note: Students should utilize TIS to determine general education courses that transfer to UWM and meet UWM general education requirements. One of the Humanities/Arts or Social/Behavioral Sciences courses need to also meet Diversity requirement. Computational skills requirement is fulfilled with MATH 111 College Algebra I. Prepared using UW-Parkside's 2017-2019 catalog. UW-Parkside courses specific for the engineering program have prefix PENG.

UW-Parkside Associate of Science in Physics / UW-Milwaukee Bachelor of Science Materials Engineering Agreement 4-Year Plan

Course	Title	Credits
Year 1		
Fall Semester		
UW-Parkside - Materials Engineering Program		
MATH 221	Calculus and Analytic Geometry I	5
PHYS 201	General Physics I	5
CHEM 101 & CHEM 103	General Chemistry I and General Chemistry Lab I	5
ENGL 101	Composition and Reading	3
	Credits	**18**
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Spring Semester		
MATH 222	Calculus and Analytic Geometry II	5
PHYS 202	General Physics II	5
PHYS 241	Scientific Programming [1]	3
PENG 211	Statics [2]	3
	Credits	**16**
Summer Semester		
Gen Ed	Humanities/Arts	3
	Credits	**3**
Year 2		
Fall Semester		
UW-Parkside - Materials Engineering Program		
COMM 105	Public Speaking for the 21st Century	3
MATH 223	Calculus and Analytic Geometry III	5
MATH 317	Differential Equations and their Applications [3]	4
PENG 212	Dynamics [4]	3
ENGL 167	Introduction to Literature (HU)	3
	Credits	**18**
Winterim Semester		
Gen Ed	Social/Behavioral Sciences	3
	Credits	**3**
Spring Semester		
CHEM 102 & CHEM 104	General Chemistry II and General Chemistry Lab II	5
PENG 214	Electrical Circuits I [5]	3
ENGL 201	Advanced Composition	3
Gen Ed	Humanities/Arts	3
Gen Ed	Social/Behavioral Sciences	3
	Credits	**17**
Summer Semester		
Gen Ed	Social/Behavioral Sciences	3
MATL ENG 201 at UWM		4
	Credits	**7**
Year 3		
Fall Semester		
UWM Materials Engineering		
EAS 200	Professional Seminar	1
CIV ENG 303	Strength of Materials	4
MATL ENG 402	Physical Metallurgy	3
MATL ENG 410	Mechanical Behavior of Materials	3
IND ENG 467	Intro to Statistics for Physical Sciences & Engineers	3
	Credits	**14**
Spring Semester		
MATL ENG 330	Materials Processing	3
MATL ENG 442	Thermodynamics of Materials	3
MATL ENG 453	Polymeric Materials	3
Technical Elective		3
	Credits	**12**
Year 4		
Fall Semester		
UWM Materials Engineering		
MATL ENG 411	Materials Laboratory	3
MATL ENG 452	Ceramic Materials	3
MATL ENG 490	Senior Design Project 1	1
3-Technical Electives		9
	Credits	**16**
Spring Semester		
MATL ENG 443	Transport & Kinetics in Materials Processing	3
MATL ENG 491	Senior Design Project 2	3
3-Technical Electives		9
	Credits	**15**
	Total Credits	**142**

[1] CompSci 240-UWM
[2] CIV ENG 201-UWM
[3] ELEC ENG 234-UWM
[4] CIV ENG 202-UWM
[5] ELEC ENG 301-UWM

Year 1

Humanities/Arts – 3/12 completed; Social/Behavioral Sciences – 3/12 completed; Natural Science 15/12 completed; Total Credits – 40 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – not complete.

Year 2

Humanities/Arts – 12/12 completed; Social/Behavioral Sciences – 12/12 completed; Natural Science 15/12 completed; Total Credits – 85 completed; UW-Milwaukee English Competency (ENGL 167 Introduction to Literature & ENGL 201 Advanced Composition) – complete.

Foreign Language may be required depending on individual student's backgrounds. Please check UW-Milwaukee requirements.

Note: Students should utilize TIS to determine general education courses that transfer to UWM and meet UWM general education requirements. One of the Humanities/Arts or Social/Behavioral Sciences courses need to also meet Diversity requirement. Computational skills requirement is fulfilled with MATH 111 College Algebra I. Prepared using UW-Parkside's 2017-2019 catalog. UW-Parkside courses specific for the engineering program have prefix PENG.

Programs Offered

- Mathematics Major (BS) (https://catalog.uwp.edu/programs/math-physics/mathematics-major/)
- Physics Major (BS) (https://catalog.uwp.edu/programs/math-physics/physics-major/)
- Mathematics Minor (https://catalog.uwp.edu/programs/math-physics/mathematics-minor/)
- Physics Minor (https://catalog.uwp.edu/programs/math-physics/physics-minor/)

- Physics (AS) (https://catalog.uwp.edu/programs/associate-degree-programs/physics/)

Courses in Math

MATH 100 | Foundations of College Mathematics | 2 cr
Covers arithmetic, linear expressions and equations, linear graphs, exponents, and polynomial multiplication and factoring in preparation for MATH 102, MATH 104, and MATH 111.
Prerequisites: None.
Offered: Fall, Spring.

MATH 102 | Quantitative Reasoning | 4 cr
Covers topics selected from review of algebra fundamentals, sets, logic, number theory, geometry, consumer math, linear and exponential modeling, math and the arts, voting methods, probability, and statistics. Intended for students who need no further mathematics courses beyond competency.
Prerequisites: MATH 100 with a grade of C- or better; or appropriate placement.
Offered: Fall, Spring.
Meets: Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills

MATH 103 | Elementary Statistics | 4 cr
Introduces modern statistics including statistics and data, displaying descriptive statistics, measures of central tendency and dispersion, probability and counting, the binomial and normal probability distributions, sampling and sampling distributions, confidence intervals, hypothesis testing; and correlation and regression. Not open to students with credits in any of these courses: BIOS 210, GEOS 295, MATH 203, POLS 200, PSYC 250, QM 210, 310, SOCA 250, 295 or 300. Four-hour lecture.
Prerequisites: MATH 100 with a grade of C- or better; or appropriate placement.
Offered: Fall, Spring.
Meets: Natural Science: MATH, Computational Skills, Computational Skills, Natural Science: MATH, Computational Skills, Computational Skills, Natural Science: MATH, Computational Skills, Computational Skills, Natural Science: MATH, Computational Skills, Computational Skills, Natural Science: MATH, Computational Skills, Computational Skills

MATH 104 | College Mathematics with Applications | 4 cr
Covers topics from college algebra (such as functions, linear, exponential and logarithmic models), statistics, and graphing. Emphasizes proportional reasoning, modeling, problem-solving and applications. Intended for students whose program does not require further coursework in pre-calculus or calculus. Four-hour lecture.
Prerequisites: MATH 100 with a grade of C- or better; or appropriate placement.
Offered: Fall, Spring.
Meets: Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills

MATH 105AX | Business Algebra Fundamentals | 2 cr
Models business scenarios using algebraic techniques and analysis to help solve business problems and make predictions. Successfully completing MATH 105AX, MATH 105BX, and MATH 105CX satisfies the UW-P computational skills requirement for flexible option students.
Prerequisites: Admission to the Flexible Option Program and consent of program representative.

MATH 105BX | Money in the Bank: Application of Exponential and Logarithmic Functions | 1 cr
Covers evaluation of investment options, including factors such as interest rate, compounding period, and length of contract. Applies exponential and logarithmic functions to determine the best investment options. Successfully completing MATH 105AX, MATH 105BX, and MATH 105CX satisfies the UW-P computational skills requirement for flexible option students.
Prerequisites: MATH 105AX; admission to the Flexible Option Program and consent of program representative.

MATH 105CX | Application of Algebraic Methods to Model and Solve Business Problems | 1 cr
Models business scenarios using algebraic methods. Identifies and applies the best method to solve the business problems. Successfully completing MATH 105AX, MATH 105BX, and MATH 105CX satisfies the UW-P computational skills requirement for flexible option students.
Prerequisites: MATH 105BX; admission to the Flexible Option Program and consent of program representative.

MATH 110 | Cultural Perspectives of Mathematics | 3 cr
Surveys the development of mathematics through a variety of cultural perspectives. Includes the historical evolution of counting systems, mathematical tools, geometry, and other mathematical techniques. Examines how mathematics is used and portrayed in modern society and what biases exist in our understanding of mathematics and mathematicians.
Prerequisites: None.
Offered: Spring.
Meets: Natural Science: MATH, Natural Science: MATH, Natural Science: MATH, Natural Science: MATH, Natural Science: MATH

MATH 111 | College Algebra I | 5 cr
Explores linear equations, single and compound inequalities, and absolute value equations and inequalities; equations of lines and linear systems; exponential and polynomial operations with function evaluation; polynomial factoring by combinations of GCF, grouping, trinomial including quadratic-in-form, difference of squares, and sum and difference of cubes; quadratic and higher-degree equations by factoring; rational operations and equations; variation; radical operations and equations with up to two radical terms; complex numbers; completing the square and quadratic formula for quadratic equations; general polynomial equations; quadratic functions with graphing; introduction to exponential and logarithmic functions and equations.
Prerequisites: MATH 100 with a grade of C- or better; or appropriate placement.
Offered: Fall, Spring.
Meets: Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills, Computational Skills

MATH 112 | College Algebra II | 4 cr

Explores functions and graphs, polynomial functions, exponential and logarithmic functions, sequences, series, induction and combinatorics. Four hour lecture.

Prerequisites: MATH 111 with C or better; or equivalent; or appropriate placement.

Offered: Fall, Spring.

MATH 113 | Trigonometry | 2 cr

Introduces trigonometry with applications including angular and circular definitions of trigonometric functions, graphing, use of fundamental identities.

Prerequisites: MATH 112 or equivalent or concurrent registration.

Offered: Fall, Spring.

MATH 114 | College Algebra II/Trigonometry | 5 cr

Covers functions and graphs, polynomials and rational functions, exponential and logarithmic functions, trigonometric functions, trigonometric identities and equations, applications, sequences, series. Not open to those with credit in MATH 112 or 113.

Prerequisites: MATH 111 with C or better; or equivalent, or appropriate placement; not open to those with credit in MATH 112 or MATH 113.

Offered: Fall, Spring.

MATH 203 | Intermediate Statistics | 3 cr

Introduces inferential statistics including elementary combinatorics and probability, binomial and normal distributions, Central Limit Theorem, estimation, confidence intervals, hypothesis testing, correlation, regression, chi-square distribution, and analysis of variance.

Prerequisites: Successful completion of Computational Skills requirement.

Offered: Spring.

MATH 215 | Math for Middle Childhood Through Early Adolescence Teachers I | 3 cr

Topics include the development of the algorithms of arithmetic, numeration systems, problem solving, number theory and set theory.

Prerequisites: MATH 111 with grade of C or better or consent of instructor.

Offered: Occasionally.

MATH 216 | Math for Middle Childhood Thru Early Adolescence Teachers II | 3 cr

Topics include introductory geometry, constructions, congruence, similarity, motion geometry, concepts of measurements, probability and statistics.

Prerequisites: MATH 215.

Offered: Occasionally.

MATH 221 | Calculus and Analytic Geometry I | 5 cr

Explains rate of change and limits, differentiation, applications of the derivative, integration, applications of the integral and transcendental functions.

Prerequisites: MATH 112 and MATH 113 or equivalent; or appropriate placement.

Offered: Fall, Spring.

Meets: Natural Science: MATH, Natural Science: MATH, Natural Science: MATH, Natural Science: MATH, Natural Science: MATH

MATH 222 | Calculus and Analytic Geometry II | 5 cr

Examines methods of integration, analytic geometry, polar coordinates, hyperbolic functions, infinite series, power series, and introduces ordinary differential equations.

Prerequisites: MATH 221.

Offered: Fall, Spring.

Meets: Natural Science: MATH, Natural Science: MATH, Natural Science: MATH, Natural Science: MATH, Natural Science: MATH

MATH 223 | Calculus and Analytic Geometry III | 5 cr

Explains vectors and parametric equations, vector functions and their derivatives, partial and directional derivatives, multiple integrals, vector analysis, Green's Theorem and Stokes' Theorem.

Prerequisites: MATH 222.

Offered: Fall.

MATH 231 | Discrete Mathematics | 3 cr

Covers sets; the number system; Boolean algebra; formal logic and proofs; relations and functions; combinatorics and recurrence relations; graphs and trees. Cross-listed with: CSCI 231.

Prerequisites: MATH 112 with a C or better.

Offered: Fall, Spring.

MATH 290 | Special Topics in Mathematics | 1-4 cr

Selected topics in mathematics will be examined.

Prerequisites: None.

Offered: Occasionally.

MATH 301 | Linear Algebra | 4 cr

Introduction to linear algebra including systems of equations, matrices, determinants, vector spaces and linear transformations, and diagonalization.

Prerequisites: MATH 223; or MATH 222 and consent of instructor.

Offered: Fall.

MATH 303 | Set Theory, Logic and Proof | 4 cr

Examines elementary propositional and predicate logic; language and axioms of set theory; operations on sets; well-orderings, ordinals, transfinite induction and recursion; cardinals; the axiom of choice; combinatorics; reading and writing of proofs in mathematics. Cross-listed with: PHIL 303.

Prerequisites: MATH 222; or PHIL 201 and consent of instructor.

Offered: Fall.

MATH 309 | Probability and Statistics | 3 cr

Covers elementary probability, random variables, properties of distributions, sampling, queuing theory, central limit theorem and law of large numbers. Cross-listed with: CSCI 309.

Prerequisites: MATH 221 with a C or better.

Offered: Spring.

MATH 310 | Advanced Probability Theory and Statistics | 4 cr

The main mathematical methods and techniques of probability theory; random variables, expected values, variance, central limit theorem, parameter estimation and hypothesis testing.

Prerequisites: MATH 223.

Offered: Fall.

MATH 317 | Differential Equations and their Applications | 4 cr

Examines first- and second-order differential equations and applications; higher-order linear differential equations; series solutions of second-order differential equations; Laplace transforms; matrix algebra, systems of equations, eigen values and eigenvectors; systems of differential equations; and partial differential equations.

Prerequisites: MATH 222.

Offered: Fall.

MATH 331 | Logic and Combinatorics | 3 cr

Permutations and combinations, graphs, trees, mathematical induction, propositional calculus, Mathematica and its applications in combinatorics, number theory and linear programming. Intended for students working for teaching certification in Mathematics.
Prerequisites: MATH 222.

MATH 350 | Advanced Calculus | 4 cr

Covers the fundamental notions of limits, continuity, uniform continuity, derivative, and integral. Examines infinite series with a study of convergence and uniform convergence.
Prerequisites: MATH 223, MATH 303.
Offered: Spring.

MATH 361 | Foundations of Geometry | 3 cr

Introduction to axiomatic geometry including Euclidean, non-Euclidean, and projective geometries.
Prerequisites: MATH 222.

MATH 367 | Elementary Number Theory | 4 cr

Prime numbers, fundamental theorem of arithmetic, congruence, quadratic residues and quadratic reciprocity, number theoretic functions and diophantine equations.
Prerequisites: MATH 222.

MATH 368 | Mathematical Modeling | 3 cr

Surveys mathematical models, models involving differential equations, probabilistic models, Markovian-models, simulation, and Monte Carlo methods. Cross-listed with: CSCI 368.
Prerequisites: MATH 222; PHYS 241 or CSCI 130; or consent of instructor.
Offered: Yearly.

MATH 370 | Numerical Analysis | 4 cr

Introduces theory and practical use of certain basic numerical methods that often arise in applications. Covers numerical methods for solving linear and nonlinear equations, approximating functions, computing integrals, and derivatives.
Prerequisites: MATH 317 or consent of instructor.
Offered: Spring.

MATH 373 | History of Mathematics | 3 cr

Main lines of mathematical development from the Babylonians, Egyptians and Greeks to the present day; the lives of great mathematicians: Euclid, Archimedes, Descartes, Newton, Gauss, Cantor.
Prerequisites: MATH 221 or consent of instructor.
Offered: Occasionally.

MATH 401 | Applied Mathematics | 3 cr

Explores traditional analytical and numerical methods enriched by modern mathematical developments and applications to various fields such as ocean and atmospheric sciences. Combines approximate forms of the basic mathematical equations of motion with analysis.
Prerequisites: MATH 223 and MATH 317.
Offered: Fall (odd years).

MATH 423 | Complex Analysis | 4 cr

Examines elementary functions of a complex variable; analytic -functions; complex integrals and residue theory; conformal mapping; applications to electrostatics and hydrodynamics.
Prerequisites: MATH 223, MATH 303.
Offered: Spring.

MATH 441 | Abstract Algebra | 4 cr

A study of group theory which includes subgroups, normal subgroups, isomorphisms, quotient groups, Cayley's Theorem, and Lagrange's Theorem. Provides an introduction to ring theory which includes subrings, ideals and factor rings, and polynomial rings.
Prerequisites: MATH 301, MATH 303 or consent of instructor.
Offered: Fall.

MATH 451 | Topology | 4 cr

Explores theory of topological spaces, metric spaces, continuous functions, connectedness, compactness, and manifolds.
Prerequisites: MATH 301 and MATH 350; or consent of instructor.
Offered: Occasionally.

MATH 461 | Differential Geometry | 3 cr

Local theory of curves and surfaces, curvature tensors, and global theory of surfaces.
Prerequisites: MATH 301 and MATH 350.
Offered: Occasionally.

MATH 490 | Special Topics in Mathematics | 1 cr

Intensive treatment of various specialized areas of mathematics.
Prerequisites: Instructor consent.
Offered: Occasionally.

MATH 495 | Senior Seminar | 1-2 cr

Research and presentation of selected topics from the mathematical literature.
Prerequisites: Senior standing and consent of instructor.
Offered: Fall.

MATH 499 | Independent Study | 1-4 cr

Prerequisites: Consent of instructor and department chair.
Offered: Occasionally.

Courses in Physics

PHYS 101 | Principles of Physics | 4 cr

A one-semester introduction to fundamental principles of physics, their experimental basis, and applications. For students who need an introductory course in physics. Not open to students with credit in PHYS 105 or 201. Three-hour lecture/demo; one-hour discussion.
Prerequisites: Completion of computational skills requirement or equivalent.
Offered: Fall, Spring.
Meets: Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS

PHYS 105 | College Physics I | 5 cr

Mechanics, heat, and sound. Not recommended for students majoring in physical science or engineering. Not open to students with credit in PHYS 201. Three-hour lecture; one-hour discussion; three-hour lab. Enrollment in Lecture, Discussion, and a Lab required.
Prerequisites: MATH 113, MATH 114 or equivalent.
Offered: Fall.
Meets: Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS

PHYS 106 | College Physics II | 5 cr

Electricity and magnetism, light and modern physics. Not open to students with credit in PHYS 202. Three-hour lecture; one-hour discussion; three-hour lab.
Prerequisites: PHYS 105.
Offered: Spring.

PHYS 110 | Introduction to Astronomy | 3 cr
Explores astronomy for non-scientists with limited mathematics. Introduces the celestial sphere, constellations, and planets. Investigates topics such as solar system objects, cosmic distance scale, exoplanets, stellar evolution, galactic structure, and cosmology. Three-hour lecture.
Prerequisites: None.
Offered: Occasionally.
Meets: Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS

PHYS 120 | Astronomy of Native America | 3 cr
Examines the astronomical views of Native Americans and looks at how mythos, science and discrimination intersect. Evaluates current cultural conflicts between science and native groups. Draws additional examples of the cultural development of astronomy and science from the Americas, Africa, Oceania, and Asia. Community-based learning designation. Cross-listed with: ETHN 120.
Prerequisites: None.
Offered: Fall, Spring.
Meets: Natural Science: PHYS, Ethnic Diversity, Community Based Learning, Natural Science: PHYS, Ethnic Diversity, Community Based Learning, Natural Science: PHYS, Ethnic Diversity, Community Based Learning, Natural Science: PHYS, Ethnic Diversity, Community Based Learning, Natural Science: PHYS, Ethnic Diversity, Community Based Learning

PHYS 150 | Physics of Music | 3 cr
An introduction to the basic physical principles underlying music and musical instruments. Not for credit towards Physics major.
Prerequisites: None.
Offered: Fall.
Meets: Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS

PHYS 201 | General Physics I | 5 cr
Investigates mechanics, heat, and sound. For physical science and engineering majors. Enrollment in Three-hour lecture; one-hour discussion; three-hour lab required.
Prerequisites: MATH 221 with C or higher or concurrent registration.
Offered: Fall, Spring.
Meets: Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS, Natural Science: PHYS

PHYS 202 | General Physics II | 5 cr
Investigates electricity and magnetism, geometrical optics, and physical optics. For physical science and engineering majors. Enrollment in Three hour lecture; one-hour discussion; three-hour lab required.
Prerequisites: PHYS 201; MATH 222 or concurrent registration.
Offered: Fall, Spring.

PHYS 205 | Modern Physics | 3 cr
Special relativity. Elements of quantum mechanics. Introduction to atomic, molecular, solid state, nuclear, and particle physics. Three-hour lecture.
Prerequisites: PHYS 202.
Offered: Fall.

PHYS 213 | Thermodynamics | 3 cr

PHYS 241 | Scientific Programming | 3 cr
Studies programming in MATLAB and another high-level language, such as Python, with applications to science and engineering.
Prerequisites: PHYS 201; MATH 221 or consent of instructor.
Offered: Spring.

PHYS 290 | Special Topics in Physics | 1-4 cr
Special topics in physics will be examined.
Prerequisites: Consent of instructor.
Offered: Occasionally.

PHYS 295 | Physics Research Seminar I | 1 cr
Introduces students to branches and interdisciplinary fields of physics; experimental, theoretical, and computational. Emphasizes the breadth of applicability of physics as well as current areas of interest, through note-taking, discussions, and other resources. Leads to individual student oral presentation on physics topic of choice.
Prerequisites: PHYS 202 or concurrent enrollment; or consent of instructor.
Offered: Fall.

PHYS 297 | Physics Research Seminar II | 1 cr
Second research seminar course. Introduces students to branches and interdisciplinary fields of physics; experimental, theoretical, and computational. Emphasizes the breadth of applicability of physics as well as current areas of interest, through note-taking, discussions, and other resources. Leads to individual student written presentation on physics topic of choice.
Prerequisites: PHYS 202 or concurrent enrollment; or consent of instructor.
Offered: Spring.

PHYS 301 | Classical Mechanics | 4 cr
Vector analysis, conservation laws, planetary motion, rigid body dynamics, free and forced oscillations, normal coordinates, moving coordinate systems, generalized coordinates, Lagrangian and Hamiltonian formulations. Continuum mechanics. Four-hour lecture.
Prerequisites: PHYS 201 and PHYS 202 with a grade of C or better; MATH 317, or concurrent registration or consent of instructor.
Offered: Fall (even years).

PHYS 302 | Electricity and Magnetism | 4 cr
Examines electrostatics, magnetostatics, and electromagnetic fields through Maxwell's equations with basic applications. Includes radiation, Lienard-Wiechert potentials, sources of radiation, antenna theory, scalar diffraction theory and wave optics for transparent or conductive media. Four-hour lecture.
Prerequisites: PHYS 201 and PHYS 202 with grades of C or better; MATH 317 or concurrent registration; or consent of instructor.
Offered: Spring.

PHYS 303 | Computational Physics | 3 cr
Introduces computational physics with applications to classical mechanics, electromagnetism, and quantum mechanics. Monte Carlo methods. Introduction to molecular dynamics. Three-hour lecture.
Prerequisites: PHYS 201 and PHYS 202 with a grade of C or better; PHYS 205; MATH 223, PHYS 241, or consent of instructor.
Offered: Spring.

PHYS 306 | Advanced Experiments in Physics | 3 cr
Covers advanced experiments in optics, atomic, molecular, solid state, and nuclear physics. Analog electronics through transistors and op-amps. Basic digital electronics. Six-hour lab.
Prerequisites: PHYS 201 and 202 with a grade of C or better; PHYS 205.
Offered: Spring (odd years).

PHYS 401 | Mathematical Methods of Physics | 3 cr

Applies mathematical methods to physical sciences with emphasis on physics. Covers a wide range of mathematical methods, including vector and tensor analysis and coordinate transformations, complex variables, Fourier series and integral transforms, Sturm-Liouville systems and orthogonal functions, partial differential equations, calculus of variations, and probability and statistics.
Prerequisites: MATH 223 and 317.
Offered: Fall (even years).

PHYS 403 | Thermodynamics | 3 cr

Examines laws of thermodynamics, and equations of state and state variables to describe thermodynamic systems at or near equilibrium. Covers Legendre transformations and thermodynamic potentials, Maxwell relations, and phase transformations. Investigates applications of thermodynamics such as heat engines, refrigerators, and liquefaction of gases under extreme conditions.
Prerequisites: PHYS 201, PHYS 202 with grades of C or better; MATH 223, MATH 317.
Offered: Spring.

PHYS 413 | Statistical Mechanics | 3 cr

Delves into classical and quantum statistical mechanics: Maxwell-Boltzmann speed distribution, partition functions, statistical ensembles, black body radiation, Debye theory of solids, Fermi and Bose gases, and the Ising model.
Prerequisites: PHYS 403 or consent of instructor.
Offered: Fall.

PHYS 441 | Quantum Physics | 4 cr

Explores quantum mechanics, free particle in wave mechanics, particles in one-dimensional potentials, axiomatic foundations of quantum mechanics, the evolution of states in time, particles in three dimensions, angular momentum, central potentials. Introduces the concept of spin and the exclusion principle, and the Dirac equation with its associated henomenology. Four-hour lecture.
Prerequisites: PHYS 201 and PHYS 202 with grades of C or better; PHYS 205; MATH 301 and MATH 317 or MATH 401; or consent of instructor.
Offered: Spring (odd years).

PHYS 490 | Special Topics in Physics | 1-4 cr

Examines special topics in physics.
Prerequisites: PHYS 201 and PHYS 202 with grades of C or better and consent of instructor.
Offered: Occasionally.

PHYS 494 | Internship in Physics | 1-3 cr

Work in a physics-related position under joint supervision of a physics faculty and a member of the sponsoring public or private organization. Consent of instructor and department chair.
Prerequisites: PHYS 201 and PHYS 202 with C or better in each; GPA of 2.5 or higher.
Offered: Fall, Spring, Summer.

PHYS 495 | Senior Seminar | 2 cr

Provides opportunity for a directed study of a current topic in physics.
Prerequisites: PHYS 201 and PHYS 202 with C or better in both; junior or senior standing.
Offered: Fall, Spring.

PHYS 497 | Senior Thesis | 1-2 cr

Investigates advanced topics in physics.
Prerequisites: PHYS 201 and PHYS 202 with C or better; and consent of instructor.
Offered: Occasionally.

PHYS 499 | Independent Study | 1-3 cr

Investigates advanced topics in physics.
Prerequisites: PHYS 201 and PHYS 202 with C or better; consent of instructor and department chair.
Offered: Occasionally.

Courses in Pre-Engineering

PENG 211 | Statics | 3 cr

Discusses vectors, equilibrium of a particle, resultants of force systems, equilibrium of rigid bodies in two and three dimensions, structural analysis, friction, centroids, and moments of inertia. Required for the pre-engineering articulation agreement with UW-Milwaukee.
Prerequisites: MATH 221 with a grade of C or better, concurrent registration in MATH 222.
Offered: Spring.

PENG 212 | Dynamics | 3 cr

Covers motion and the laws of motion in different dimensions of space using various orthogonal curvilinear coordinates; relative motion; work and energy; conservative forces and potential energy; conservation of linear and angular momentum; and rigid body motion. Required for the pre-engineering articulation agreement with UW-Milwaukee.
Prerequisites: MATH 222 with a C or better, PENG 211; concurrent registration in Math 223.
Offered: Fall.

PENG 214 | Electrical Circuits I | 3 cr

Covers circuit laws and analysis, restrictive circuits, energy storage, AC circuits and power, three-phase circuits, and computer-aided analysis. Required for the pre-engineering articulation agreement with UW-Milwaukee.
Prerequisites: PHYS 202 with a grade of C or better.
Offered: Fall.

PENG 215 | Materials Science and Engineering | 4 cr

Introduces materials science and engineering. Covers the structure and basic properties of various engineering materials, including metals and alloys, ceramics, plastics, and composite materials. Includes laboratory work.
Prerequisites: CHEM 101, MATH 222 and PHYS 202.
Offered: Fall.

PENG 216 | Engineering Drawing and Computer Aided Design | 3 cr

Covers fundamentals of computer aided design (CAD), solid modeling, engineering drawings, dimensioning and specifications.
Prerequisites: MATH 112 and 113; or MATH 114.
Offered: Spring.