# **ENGINEERING PHYSICS (BS)**

The Department of Physics and Astronomy offers a wide variety of courses and programs that examine and employ the laws of nature from both theoretical and applied perspectives.

Transfer students pursuing a major in Engineering Physics must take a minimum of 40% of the coursework required for the major at Benedictine College.

#### Guidelines for Acceptance to a Physics & Astronomy Department Major

In order to ensure that students are on a successful academic trajectory, it is recommended that students who have not earned at least a C average in both Classical Physics I and II should not declare a major in the Physics & Astronomy Department. Students who have not achieved this minimum grade guideline but who still seek acceptance to a major in one of the programs in the Physics & Astronomy Department must meet with and receive approval from the Department Chair.

### **Program Mission**

The mission of the Engineering Physics Program is to combine the fundamental principles of physics with the engineering disciplines to enable students to solve real-world problems for the benefit of society, thereby allowing students to engage in a wide range of pursuits and professional advancements especially in academics or industry.

#### **Program Outcomes**

- 1. Graduates will have knowledge of physics and its role within the liberal arts.
- 2. Graduates will be able to function as both a physicist and an engineer.
- 3. Graduates will be competent in laboratory skills and in the theory and application of data analysis, economic analysis, and design.
- 4. Graduates will have the tools to achieve personal and careers goals in a spectrum of pursuits, such as academics, education, industry, and health science.
- Graduates will have the interpersonal and professional skills to solve technically complex problems working individually or as a member or leader of teams of varied cultural and experiential background regardless of cultural differences.

## **Program Requirements**

Code	Title	Hours
Requirements (65	5 hours)	
ENGR-1500	Technical Drawing	2
ENGR-1200	Introduction to Engineering	2
ENGR-2300	Statics	3
ENGR-2310	Dynamics	3
or PHYS-4100	Mechanics I	
ENGR-3170	Engineering Economy & Society	3
ENGR-2320	Mechanics of Materials	3
ENGR-3300	Fluid Mechanics	3
ENGR-3410	Thermofluids Laboratory	2
Select one of the	following:	3-5
ENGR-3500	Materials Science (3)	

or PHYS-4700	(3) and ENGR-3400 (2)	
ENGR-3600	Heat & Mass Transfer	3
PHYS-2100 & PHYS-2101	Classical Physics I and Classical Physics I Lab	4
PHYS-2110 & PHYS-2111	Classical Physics II and Classical Physics II Lab	4
PHYS-3200	Relativity & Atomic Physics	3
PHYS-3201	Modern Physics Lab	1
Select one of the	following:	3
PHYS-3210 & PHYS-3211	Nuclear & Elementary Particle Physics and Modern Physics Lab II	
or Technical El	ective	
Select one of the	following:	4
EENG-2060 & EENG-3060	Linear Circuit Analysis I and Circuits Laboratory I	
or PHYS-3500		
PHYS-4400 or ENGR-3250	Thermodynamics Thermodynamics	3
PHYS-4600	Electricity & Magnetism I	3
PHYS-COMP	Senior Comprehensive Exam	0
PHYS-4900 & PHYS-4901 & PHYS-4902	Physics Colloquium and Physics Colloquium and Physics Colloquium	0
& PHYS-4903	and Physics Colloquium	
PHYS-4910	Physics & Astronomy Research	1
	ing Courses (25 hours)	
MATH-1300	Calculus I	4
MATH-1350	Calculus II	4
MATH-2300		4
MATH-3100	Differential Equations	3
CHEM-1200	General Chemistry I Lecture	3
CHEM-1201	General Chemistry I Laboratory	1
Select one of the		4
CHEM-1210 & CHEM-1211 or Technical El		
Select one of the		2-3
ENGR-2000	Computer Applications in Engineering	20
	(Programming for Scientists & Engineers	
	es (9 credits, chosen from the following):	9
PHYS-4300	Optics (3)	,
PHYS-4301	Optics Laboratory (1)	
PHYS-4610	Electricity & Magnetism II (3)	
PHYS-4110	Mechanics II (3)	
MENG-4240	System Dynamics & Control (3)	
MENG-3180	Manufacturing Proccess Lab I (1)	
MENG-3220	Design of Machinery (3)	
MENG-4700	Senior Seminar (1)	
MENG-4730	Mechanical Measurements & Control Lab (2)	
ENGR-3150	Statistical Analysis of Data (3)	
MATH-2500	Linear Algebra (3)	
MATH-3300	Numerical Computation (3)	
	one course chosen from the following):	2-3

T	otal Hours		91-95
	MENG-4730	Mechanical Measurements & Control Lab (2)	
Instrumentation Elective:			2
	CIVL-4600	Civil Engineering Design (3)	
	MENG-4610	Mechanical Engineering Design II (3)	
	MENG-4600	Engineering Design I (3)	
	MENG-3240	Junior Design (2)	

# Suggested Sequence of Courses for a Bachelor of Science Degree in Engineering Physics

Freshman Year           First Semester           ENGR-1200         Introduction to Engineering         2           GNST-1000         BC Experience         1           MATH-1300         Calculus I         4           PHYS-2100         Classical Physics I         3           PHYS-2101         Classical Physics I Lab         1           PHIL-1750         Principles of Nature         3           CHEM-1200         General Chemistry I Lecture         3           CHEM-1200         General Chemistry I Laboratory         1           Hours         18         5           Second Semester         1         4           PHYS-2110         Classical Physics II         4           PHYS-2110         Classical Physics II Lab         1           ENGL-1010         English Composition         3           Select one of the following:         4         4           CHEM-1210         General Chemistry II Lecture         &           & CHEM-1210         General Chemistry II Lecture         &           & CHEM-1210         General Chemistry II Lecture         3           PHYS-3200         Relativity & Atomic Physics         3           PHYS-3200         Relativity & Atomic Physics </th <th>Course</th> <th>Title</th> <th>Hours</th>	Course	Title	Hours		
ENGR-1200Introduction to Engineering2GNST-1000BC Experience1MATH-1300Calculus I4PHYS-2101Classical Physics I Lab1PHYS-2101Classical Physics I Lab1PHIL-1750Principles of Nature3CHEM-1200General Chemistry I Lecture3CHEM-1201General Chemistry I Laboratory1Hours18Second SemesterENGR-1500Technical Drawing2MATH-1350Calculus II4PHYS-2110Classical Physics II Lab1ENGL-1010English Composition3Select one of the following:44CHEM-1210General Chemistry II Lecture4& CHEM-1210General Chemistry II Lab1or Technical Elective17Sophomore YearFirst SemesterPHYS-3200PHYS-3201Modern Physics Lab1ENGR-2300Statics3MATH-2300Calculus III4THE0-1100Introduction to Theology3Select one of the following:3-55PHYS-4700Condensed Matter Physics3-5PHYS-4700Condensed Matter Physics3-5PHYS-4700Condensed Matter Physics3-5PHYS-4700Condensed Matter Physics3-5PHYS-4700Condensed Matter Physics3-5PHYS-4700Condensed Matter Physics3-5<	Freshman Year				
GNST-1000 BC Experience 1 MATH-1300 Calculus I 4 PHYS-2100 Classical Physics I Lab 1 PHIS-2101 Classical Physics I Lab 1 PHIL-1750 Principles of Nature 3 CHEM-1200 General Chemistry I Lecture 3 CHEM-1201 General Chemistry I Laboratory 1 Hours 18 Second Semester ENGR-1500 Technical Drawing 2 MATH-1350 Calculus II 4 PHYS-2110 Classical Physics II 3 PHYS-2111 Classical Physics II 4 PHYS-2110 Classical Physics II 4 ENGL-1010 English Composition 3 Select one of the following: 4 CHEM-1210 General Chemistry I Lecture & & CHEM-1210 General Chemistry II Lecture & & CHEM-1210 General Chemistry II Lab 1 ENGL-1010 English Composition 3 Select one of the following: 4 CHEM-1210 General Chemistry II Lab 1 or Technical Elective 1 Hours 17 Sophomore Year First Semester PHYS-3200 Relativity & Atomic Physics 3 PHYS-3201 Modern Physics Lab 1 ENGR-2300 Statics 3 MATH-2300 Calculus III 4 THEO-1100 Introduction to Theology 3 Select one of the following: 3-5 PHYS-4700 Condensed Matter Physics \$ & ENGR-3400 and Materials Laboratory 3 Select one of the following: 3-5 PHYS-4700 Condensed Matter Physics \$ & ENGR-3500 T Hours 17-19 Second Semester Select one of the following: 3 PHYS-3210 Nuclear & Elementary Particle Physics \$ & PHYS-3210 Nuclear & Elementary Particle Physics \$ & PHYS-3211 and Modern Physics Lab II	First Semester				
MATH-1300 Calculus I 4 PHYS-2100 Classical Physics I 3 PHYS-2101 Classical Physics I Lab 1 PHIL-1750 Principles of Nature 3 CHEM-1200 General Chemistry I Lecture 3 CHEM-1201 General Chemistry I Laboratory 1 Hours 18 Second Semester ENGR-1500 Technical Drawing 2 MATH-1350 Calculus II 4 PHYS-2110 Classical Physics II 2 MATH-1350 Calculus II 3 PHYS-2111 Classical Physics II Lab 1 ENGL-1010 English Composition 3 Select one of the following: 4 CHEM-1210 General Chemistry II Lecture & CHEM-1210 General Chemistry II Lab 1 er CHEM-1210 General Chemistry II Lab 1 or Technical Elective 7 First Semester PHYS-3200 Relativity & Atomic Physics 3 PHYS-3201 Modern Physics Lab 1 ENGR-2300 Statics 3 MATH-2300 Calculus III 4 THEO-1100 Introduction to Theology 3 Select one of the following: 3-5 PHYS-4700 Condensed Matter Physics 4 ENGR-3400 and Materials Laboratory 3 Select one of the following: 3-5 PHYS-4700 Condensed Matter Physics 3 PHYS-3210 Nuclear & Elementary Particle Physics 3 PHYS-3210 Nuclear & Elementary Particle Physics 3 PHYS-3210 Nuclear & Elementary Particle Physics 3 PHYS-3211 and Modern Physics Lab II	ENGR-1200	Introduction to Engineering	2		
PHYS-2100Classical Physics I3PHYS-2101Classical Physics I Lab1PHIL-1750Principles of Nature3CHEM-1200General Chemistry I Lecture3CHEM-1201General Chemistry I Laboratory1HoursSecond SemesterENGR-1500Technical Drawing2MATH-1350Calculus II4PHYS-2110Classical Physics II Lab1ENGL-1010English CompositionSelect one of the following:4CHEM-1210General Chemistry II Lecture & CHEM-12104Or Technical Drawing Number of Technical ElectiveTo classical Physics II Labor Technical ElectiveHours17Sophomore YearFirst SemesterPHYS-3200Relativity & Atomic Physics3PHYS-3200Relativity & Atomic Physics3Select one of the following:3-5PHYS-4700Condensed Matter Physics & ENGR-34003Select one of the following:3-5PHYS-4700Condensed Matter Physics & ENGR-35003Select one of the following:3-5PHYS-3210Nuclear & Elementary Particle Physics & PHYS-32113PHYS-3211Nuclear & Elementary Particle Physics & PHYS-3211 <td <="" colspan="2" td=""><td>GNST-1000</td><td>BC Experience</td><td>1</td></td>	<td>GNST-1000</td> <td>BC Experience</td> <td>1</td>		GNST-1000	BC Experience	1
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ENGR-1500Technical Drawing2MATH-1350Calculus II4PHYS-2110Classical Physics II3PHYS-2111Classical Physics II Lab1ENGL-1010English Composition3Select one of the following:4CHEM-1210General Chemistry II Lecture & CHEM-12114CHEM-1211General Chemistry II Lecture & CHEM-12117Sophomore Year17First Semester7PHYS-3200Relativity & Atomic Physics3PHYS-3201Modern Physics Lab1ENGR-2300Statics3MATH-2300Calculus III4THEO-1100Introduction to Theology3Select one of the following:3-5PHYS-4700Condensed Matter Physics & ENGR-34003-5PHYS-4700Condensed Matter Physics & ENGR-340017-19Second Semester73Select one of the following:33PHYS-3210Nuclear & Elementary Particle Physics & PHYS-32113PHYS-3211and Modern Physics Lab II4		Hours	18		
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PHYS-2111Classical Physics II Lab1ENGL-1010English Composition3Select one of the following:4CHEM-1210General Chemistry II Lecture & CHEM-1211and General Chemistry II Labor Technical Elective17Sophomore YearFirst Semester17PHYS-3200Relativity & Atomic Physics3PHYS-3201Modern Physics Lab1ENGR-2300Statics3MATH-2300Calculus III4THEO-1100Introduction to Theology3Select one of the following:3-5PHYS-4700Condensed Matter Physics & ENGR-34003-5PHYS-4700Condensed Matter Physics & ENGR-350017-19Second SemesterSelect one of the following:3Select one of the following:3PHYS-3210Nuclear & Elementary Particle Physics & PHYS-32113PHYS-3211and Modern Physics Lab II3	MATH-1350	Calculus II	4		
ENGL-1010English Composition3Select one of the following:4CHEM-1210General Chemistry II Lecture & CHEM-12114& CHEM-1211and General Chemistry II Lab7or Technical Elective17Sophomore YearFirst SemesterPHYS-3200Relativity & Atomic Physics3PHYS-3201Modern Physics Lab1ENGR-2300Statics3MATH-2300Calculus III4THEO-1100Introduction to Theology3Select one of the following:3-5PHYS-4700Condensed Matter Physics & ENGR-34003-5PHYS-4700Condensed Matter Physics & ENGR-350077-19Second SemesterSelect one of the following:3Select one of the following:3PHYS-3210Nuclear & Elementary Particle Physics & PHYS-32113PHYS-3211and Modern Physics Lab II3	PHYS-2110	Classical Physics II	3		
Select one of the following:4CHEM-1210General Chemistry II Lecture & CHEM-1211and General Chemistry II Labor Technical Elective17Sophomore YearFirst SemesterPHYS-3200Relativity & Atomic PhysicsPHYS-3201Modern Physics Lab1ENGR-2300Statics3MATH-2300Calculus III4THEO-1100Introduction to Theology3Select one of the following:3-5PHYS-4700Condensed Matter Physics & ENGR-34003-5PHYS-4700Condensed Matter Physics & ENGR-350017-19Second SemesterSelect one of the following:3PHYS-3210Nuclear & Elementary Particle Physics & PHYS-32113PHYS-3211and Modern Physics Lab II3	PHYS-2111	Classical Physics II Lab	1		
CHEM-1210       General Chemistry II Lecture         & CHEM-1211       and General Chemistry II Lab         or Technical Elective       17         Sophomore Year       First Semester         PHYS-3200       Relativity & Atomic Physics       3         PHYS-3201       Modern Physics Lab       1         ENGR-2300       Statics       3         MATH-2300       Calculus III       4         THEO-1100       Introduction to Theology       3         Select one of the following:       3-5         PHYS-4700       Condensed Matter Physics         & ENGR-3400       and Materials Laboratory         or ENGR-3500       17-19         Select one of the following:       3         PHYS-3210       Nuclear & Elementary Particle Physics         & PHYS-3211       and Modern Physics Lab II	ENGL-1010	English Composition	3		
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Hours17Sophomore YearFirst SemesterPHYS-3200Relativity & Atomic Physics3PHYS-3201Modern Physics Lab1ENGR-2300Statics3MATH-2300Calculus III4THEO-1100Introduction to Theology3Select one of the following:3-5PHYS-4700Condensed Matter Physics & ENGR-34003-5PHYS-4700Condensed Matter Physics & ENGR-35007-19Second SemesterSelect one of the following:3PHYS-3210Nuclear & Elementary Particle Physics & PHYS-32113PHYS-3211and Modern Physics Lab II3	& CHEM-1211	and General Chemistry II Lab			
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PHYS-3200Relativity & Atomic Physics3PHYS-3201Modern Physics Lab1ENGR-2300Statics3MATH-2300Calculus III4THEO-1100Introduction to Theology3Select one of the following:3-5PHYS-4700Condensed Matter Physics & ENGR-34003-5PHYS-4700Condensed Matter Physics & ENGR-35007-19Second SemesterSelect one of the following:3Select one of the following:3PHYS-3210Nuclear & Elementary Particle Physics & PHYS-32113PHYS-3211and Modern Physics Lab II3	Sophomore Year				
PHYS-3201       Modern Physics Lab       1         ENGR-2300       Statics       3         MATH-2300       Calculus III       4         THEO-1100       Introduction to Theology       3         Select one of the following:       3-5         PHYS-4700       Condensed Matter Physics         & ENGR-3400       and Materials Laboratory         or ENGR-3500       Introduction to Theology         Select one of the following:       3         PHYS-3210       Nuclear & Elementary Particle Physics         & PHYS-3211       and Modern Physics Lab II	First Semester				
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MATH-2300       Calculus III       4         THEO-1100       Introduction to Theology       3         Select one of the following:       3-5         PHYS-4700       Condensed Matter Physics         & ENGR-3400       and Materials Laboratory         or ENGR-3500       Introduction         Hours         Second Semester         Select one of the following:         % Elementary Particle Physics       %         % PHYS-3210       Nuclear & Elementary Particle Physics         % PHYS-3211       and Modern Physics Lab II	PHYS-3201	Modern Physics Lab	1		
THEO-1100       Introduction to Theology       3         Select one of the following:       3-5         PHYS-4700       Condensed Matter Physics         & ENGR-3400       and Materials Laboratory         or ENGR-3500       IT-19         Second Semester       3         Select one of the following:       3         PHYS-3210       Nuclear & Elementary Particle Physics & PHYS-3211         and Modern Physics Lab II       3	ENGR-2300	Statics	3		
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PHYS-4700       Condensed Matter Physics         & ENGR-3400       and Materials Laboratory         or ENGR-3500       IT-19         Second Semester       Select one of the following: 3         PHYS-3210       Nuclear & Elementary Particle Physics         & PHYS-3211       and Modern Physics Lab II	THEO-1100	Introduction to Theology	3		
& ENGR-3400       and Materials Laboratory         or ENGR-3500       17-19         Second Semester         Select one of the following: 3         PHYS-3210       Nuclear & Elementary Particle Physics         & PHYS-3211       and Modern Physics Lab II	Select one of the following: 3-5				
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Hours     17-19       Second Semester     3       Select one of the following:     3       PHYS-3210     Nuclear & Elementary Particle Physics & PHYS-3211       and Modern Physics Lab II		and Materials Laboratory			
Second Semester       3         Select one of the following:       3         PHYS-3210       Nuclear & Elementary Particle Physics         & PHYS-3211       and Modern Physics Lab II	or ENGR-3500				
Select one of the following:       3         PHYS-3210       Nuclear & Elementary Particle Physics         & PHYS-3211       and Modern Physics Lab II		Hours	17-19		
PHYS-3210Nuclear & Elementary Particle Physics& PHYS-3211and Modern Physics Lab II					
& PHYS-3211 and Modern Physics Lab II					
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	Select one of the follo PHYS-3210	Nuclear & Elementary Particle Physics	3		
or Technical Elective	Select one of the follo PHYS-3210 & PHYS-3211	Nuclear & Elementary Particle Physics and Modern Physics Lab II	3		

MATH-3100	Differential Equations	3
Select one of the fo	llowing:	4
EENG-2060	Linear Circuit Analysis I	
& EENG-3060	and Circuits Laboratory I	
or PHYS-3500		
PHYS-4400	Thermodynamics	3
Select one of the fo	llowing:	2-3
ENGR-2000	Computer Applications in Engineering	
or CSCI-2300	or Programming for Scientists &	
	Engineers	2
Faith Foundation		3
	Hours	18-19
Junior Year		
First Semester		
PHYS-4100	Mechanics I	3
or ENGR-2310	or Dynamics	
ENGR-3170	Engineering Economy & Society	3
ENGR-3300	Fluid Mechanics	3
PHYS-4900	Physics Colloquium	0
EXSC-1115	Wellness for Life	1
Philosophical Inqui	ry Foundation	3
Foreign Language		3
	Hours	16
Second Semester		
ENGR-3600	Heat & Mass Transfer	3
ENGR-3410	Thermofluids Laboratory	2
PHYS-4901	Physics Colloquium	0
Technical Elective		3
PHYS-4910	Physics & Astronomy Research	1
Foreign Language		3
EXSC Fitness Cours		1
Aesthetic Foundatio	on	3
	Hours	16
Senior Year		
First Semester		
PHYS-4600	Electricity & Magnetism I	3
Instrumentation Ele	ctive	3
PHYS-4902	Physics Colloquium	0
Philosophical Inquir	ry Foundation	3
Technical Elective		3
Aesthetic Foundation	on	3
Historical Inquiry		3
	Hours	18
Second Semester		
PHYS-4800	Quantum Mechanics	3
Faith Foundation		3
Historical Inquiry Fo	oundation	3
Technical Elective		3
PHYS-COMP	Senior Comprehensive Exam	0
PHYS-4903	Physics Colloquium	0

Design Elective		3
	Hours	15
	Total Hours	135-138