

# SCHOOL OF SCIENCES

BIOLOGY • CHEMISTRY • COMPUTER SCIENCE • ENGINEERING PHYSICS • MATHEMATICS •  
NATURAL SCIENCE • PHYSICS

## ADMINISTRATION

DR. JOHNNY B. HOLMES, *Dean*

DR. WILLIAM J. BUSLER, *Chair, Chemistry Department*

DR. PASCAL BEDROSSIAN, *Chair, Mathematics/Computer Science*

DR. STANLEY EISEN, *Director, Pre-Professional Health Programs*

BROTHER EDWARD SALGADO, *Chair, Biology Department*

DR. JOHN A. VARRIANO, *Chair, Physics/Natural Science*

## FACULTY

### BIOLOGY

STANLEY EISEN, *Professor*

B.S., State University of New York at Stony Brook; M.A., Ph.D., Indiana University

MALINDA E. C. FITZGERALD, *Professor*

B.S., M.S., University of Memphis; Ph.D., University of Tennessee, Memphis

MARY L. OGILVIE, *Associate Professor*

B.S., M.S., Ph.D., Memphis State University

ANNA E. ROSS, *Associate Professor*

A.B., Hope College; Ph.D., Clemson University

BROTHER EDWARD SALGADO, F.S.C., *Associate Professor*

B.A., La Salle University; M.S., St. Mary's University; Ph.D., University of the Philippines

SANDRA THOMPSON-JAEGER, *Assistant Professor*

B.S. Ouachita Baptist University; M.S., Ph.D., University of Munich (Germany)

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### CHEMISTRY

WILLIAM J. BUSLER, *Professor*

B.S., Christian Brothers College;

Ph.D., University of Tennessee Center for the Health Sciences

STEWART MICHAEL CONDREN, *Professor*

B.S., University of Arkansas; M.S., Ph.D., University of Missouri-Rolla

MARGUERITE B. COOPER, *Associate Professor*

A.B., University of North Carolina; M.S., Ph.D., Memphis State University

DAVID P. DAWSON, *Assistant Professor*

B.S., Rhodes College; Ph.D. University of Arkansas

DENNIS MERAT, *Associate Professor*

B.S., Southern Methodist University; Ph.D. Texas A & M University

**MATHEMATICS/COMPUTER SCIENCE**MIGUEL B. AREDLLANO *Assistant Professor*

B.A., Cornell College; M.S., A.B.D., Mississippi State University

BROTHER JOEL BAUMEYER, F.S.C., *Professor*

B.A., M.Ed., St. Mary's College; M.A., Ph.D., St. Louis University

LEIGH C. BECKER, *Professor*B.S., Illinois Institute of Technology; M.S., University of Illinois;  
M.S., Ph.D., Southern Illinois UniversityPASCAL BEDROSSIAN, *Associate Professor*<sup>1</sup>

B.S., Christian Brothers University; M.S., Ph.D., Memphis State University

CATHY W. CARTER, *Professor*

B.A., M.A., University of Mississippi

ANDREW M. DIENER, *Assistant Professor*B.A., St. Mary's University (San Antonio, TX);  
M.S., Ph.D., Texas A&M UniversityHOLMES PEACHER-RYAN, *Assistant Professor*

A.B., Princeton University; M.S., Ph.D., University of Memphis

BROTHER WALTER SCHREINER, F.S.C., *Associate Professor*B.A., University of St. Thomas; M.S., University of Notre Dame;  
Ph.D., University of IllinoisARTHUR A. YANUSHKA, *Professor*B.A., Fordham University; M.S., State University of New York at Stony Brook;  
Ph.D., University of Illinois**PHYSICS/NATURAL SCIENCE**JOHNNY B. HOLMES, *Professor*

B.S., Rockhurst College; M.S., Ph.D., University of Miami

BROTHER JOHN MONZYK, C.P., *Assistant Professor*B.A., Bellarmine College; M.A., Catholic Theological Union;  
M.S., Ph.D., Southern Illinois UniversityJOHN A. VARRIANO, *Professor*

B.S., University of Pittsburgh; Ph.D., University of Rochester

**PROFESSORS EMERITI**

LAWRENCE GULDE

B.S., M.A.T., St. Mary's College; M.A., Boston College; Ph.D., Memphis State University

RELBUE M. MORGAN

B.S., Christian Brothers College; Ph.D., Iowa State University

BROTHER ROBERT STAUB, F.S.C.

B.S., St. Mary's College; M.A., Ph.D., University of Minnesota

<sup>1</sup> Sabbatical during Fall Semester

LYLE D. WESCOTT, JR.

B.S., Georgia Institute of Technology; Ph.D., Pennsylvania State University

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**PART-TIME FACULTY**

BROTHER KEVIN MALACHY RYAN, F.S.C., *Assistant Professor*

B.S., M.Ed., St. Mary's College

KATHLEEN SAUSER, *Lab Coordinator*

B.S., University of Tennessee at Martin; M.S., Florida Institute of Technology;

Ph.D., Memphis State University

### **MISSION**

THE SCHOOL OF SCIENCES offers programs leading to Bachelor of Science degrees in Biology, Chemistry, Computer Science, Mathematics, Natural Science, Physics, and Engineering Physics, as well as a Bachelor of Arts degree in Mathematics. Students seeking to enter schools of medicine, dentistry, pharmacy or any health related professional school traditionally enroll in the School of Sciences. The baccalaureate degrees in Biology and Chemistry are designed to meet the entrance requirements of all health related professional schools.

The course of study for each degree program is designed to meet these criteria:

1. Critical thinking, an active, purposeful, organized and disciplined effort to make sense out of our world and our lives, is the essential foundation of lifelong learning.
2. The knowledge bases and skills needed to deal effectively with the challenge of living in contemporary society are multidisciplinary.
3. A person should be able to make personal and professional decisions within religious and ethical contexts.

The degree programs are constructed to produce graduates who will be able to excel as professionals in science, who will succeed in pursuing further education in graduate or professional schools, and who will use their science background as a foundation for careers in other areas such as business, law, education, and engineering.

### **DUAL DEGREES**

Dual degrees are being offered in the School of Science between Computer Science and Mathematics. See Page 103 for details. Dual degrees are also being offered between the School of Science and the School of Engineering with Computer Science and Electrical Engineering Computer Track. See Page 89 for details.

### **DEGREE REQUIREMENTS**

In order to graduate, a student must complete 122 semester credit hours with an overall grade point average of 2.0 or above and a minimum 2.0 grade point average in the satisfaction of major requirements. In addition, every student must satisfy the requirements of 6 hours in English composition; a minimum of 18 hours in humanities/social science that must include at least 3 hours in literature, 6 hours in religious studies, 3 hours in moral values course work, and 6 hours in the social sciences; and 2 hours in Business/Technology. All Math and Natural Science requirements, and sometimes some of the other above requirements, are already specified for the majors in Science. Details on permitted or recommended courses can be found in the General Education section of this catalog.

**COURSE REQUIREMENTS FOR B.S. IN BIOLOGY**

*This paradigm applies to all biology majors including students seeking to enter health-related professional schools and other graduate programs.*

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
BIOL 111 Prin. of Biol. I & Lab .....	4	BIOL 112 Prin. of Biol. II & Lab .....	4
CHEM 113 Prin. of Chem. I & Lab .....	4	CHEM 114 Prin. of Chem. II & Lab .....	4
ENG 111 English Composition I .....	3	ENG 112 English Composition II .....	3
Elective <sup>1,2</sup> .....	3	MATH 131 Calculus I <sup>3</sup> .....	3
Orientation .....	0	Business/Tech Elective .....	3
<b>Total .....</b>	<b>14</b>	<b>Total .....</b>	<b>17</b>

<b>SOPHOMORE YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
Biology Elective & Lab <sup>4</sup> .....	4	BIOL 275 Biological Careers Choices .....	1
CHEM 211 Organic Chem. I & Lab .....	4	CHEM 212 Organic Chem. II & Lab .....	4
PHYS 201 Intro Physics I & Lab .....	4	PHYS 202 Intro Physics II & Lab .....	4
Literature Elective .....	3	Biology Elective & Lab <sup>4</sup> .....	4
<b>Total .....</b>	<b>15</b>	Social Science Elective .....	3
		<b>Total .....</b>	<b>16</b>

<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
BIOL 311 Genetics & Lab .....	4	BIOL 362 Biology Seminar .....	1
MATH 201 Applied Statistics .....	3	Biology Elective & Lab <sup>4</sup> .....	4
Chemistry <sup>5</sup> .....	4	Biology Elective & Lab <sup>4</sup> .....	4
Social Science Elective .....	3	Religious Studies Elective .....	3
Moral Values Elective <sup>6</sup> .....	3	Elective .....	3
<b>Total .....</b>	<b>17</b>	<b>Total .....</b>	<b>15</b>

**Summer:** BIOL 463 Research I<sup>7</sup> .....

<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
BIOL 464 Research <sup>7</sup> .....	2	BIOL 465 Research III <sup>7</sup> .....	2
BIOL 499 Senior Comprehensive .....	0	Biology Elective & Lab <sup>4</sup> .....	4
Biology Elective & Lab <sup>4</sup> .....	4	Biology Elective <sup>4</sup> .....	3
Biology Elective <sup>4</sup> .....	3	Elective .....	3
Elective .....	3	<b>Total .....</b>	<b>12</b>
Religious Studies Elective .....	3		
<b>Total .....</b>	<b>15</b>		

**Minimum total number of credits for graduation: 122.**

Minimum GPA of 2.0 in biology courses is required for graduation. Transfer students must take at least 20 hours of biology at or above the 300 level at Christian Brothers University.

**BIOLOGY ELECTIVES** (*Students should choose at least one course from each group*)

**Group I:** BIOL 211 Embryology; 217 Anatomy & Physiology I; 218 Anatomy & Physiology II (both 217 and 218 must be taken); 236 Nutrition; BIOL 312 Vertebrate Physiology; 414 Histology; 451 Neuroscience.

**Group II:** BIOL 212 Comparative Anatomy; 216 Botany; 335 Invertebrate Zoology; 413 Parasitology.



PHOTO BY SIMAK KEVANI

**Group III:** BIOL 246 Evolution; 381 Animal Behavior; 412 Ecology.

**Group IV:** BIOL 321 Microbiology; 367 Pharmacology; 415 Immunology; 421 Cell/Molecular Biology.

- <sup>1</sup> Students may be asked to take MATH 117 and/or CHEM 101 if they do not place into MATH 131 and/or CHEM 113
- <sup>2</sup> Minimum of 12 hours of free electives; no more than 9 hours can be in Biology
- <sup>3</sup> Math 117 is not required for those who place into MATH 131. MATH 131 and 201 are required to fulfill the requirements for Math.
- <sup>4</sup> Minimum of 30 hours of biology electives: must include at least one course from each of the four groups listed on page 97; minimum of 20 hours of biology electives must be at or above the 300 level
- <sup>5</sup> Recommended: CHEM 312 or 315-316 Biochemistry or CHEM 214 Quantitative Analysis; any chemistry class with a lab at the 200 level or above will satisfy the requirement
- <sup>6</sup> Must satisfy the moral values requirement
- <sup>7</sup> Substitute BIOL 461-462 only with permission of the Chair or Course Director. Students who take Independent Research will have to make up three credits in biology in order to complete the 122 hours required minimum for graduation.

## COURSE REQUIREMENTS FOR B.S. IN BIOLOGY CONCENTRATION IN ENVIRONMENTAL STUDIES

*This paradigm applies to biology majors who are seeking to enter graduate programs in ecology and environmental science.*

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
BIOL 111 Prin of Biology I & Lab .....	4	BIOL 112 Prin of Biology II & Lab .....	4
CHEM 113 Prin of Chemistry I & Lab .....	4	CHEM 114 Prin of Chemistry II & Lab .....	4
ENG 111 English Composition I .....	3	ENG 112 English Composition II .....	3
Elective <sup>1,2</sup> .....	3	MATH 131 Calculus I <sup>3</sup> .....	3
Orientation .....	0	Business/Tech Elective .....	3
<b>Total .....</b>	<b>14</b>	<b>Total .....</b>	<b>17</b>

<b>SOPHOMORE YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
Biology Elective & Lab <sup>4</sup> .....	4	BIOL 275 Biological Careers Choices .....	1
CHEM 211 Organic Chem I & Lab .....	4	CHEM 212 Organic Chem II & Lab .....	4
PHYS 201 Intro Physics I & Lab .....	4	PHYS 202 Intro Physics II & Lab .....	4
Literature Elective .....	3	Biology Elective & Lab <sup>4</sup> .....	4
		Social Science Elective .....	3
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>16</b>

<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
BIOL 311 Genetics & Lab .....	4	BIOL 362 Biology Seminar .....	1
MATH 201 Applied Statistics .....	3	Biology Elective & Lab <sup>4</sup> .....	4
CHEM 312 Biochemistry & Lab .....	4	Biology Elective & Lab <sup>4</sup> .....	4
Social Science Elective .....	3	Religious Studies Elective .....	3
Moral Values Elective <sup>5</sup> .....	3	Elective .....	3
<b>Total .....</b>	<b>17</b>	<b>Total .....</b>	<b>15</b>

**Summer:** BIOL 463 Research I .....

<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
BIOL 464 Research II .....	2	BIOL 465 Research III .....	2
BIOL 499 Biology Comprehensive .....	0	Environmental Biology Elective & Lab .....	4
Environmental Biology Elective & Lab .....	4	Biology Elective .....	3
Biology Elective .....	3	Elective .....	3
Religious Studies Elective .....	3		
Elective .....	3		
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>12</b>

**Minimum total number of credits for graduation: 122.**

Minimum GPA of 2.0 in biology courses is required for graduation. Transfer students must take at least 20 hours of biology at or above the 300 level at Christian Brothers University.

### **BIOLOGY ELECTIVES** (*These groups apply to the Environmental concentration*)

**Group I:** BIOL 217 Anatomy and Physiology II (both 217 and 218 must be taken); BIOL 312 Vertebrate Physiology; 421 Cell/Molecular Biology; 451 Neuroscience.

**Group II:** BIOL 216 Botany; 321 Microbiology; 335 Invertebrate Zoology; 413 Parasitology.



PHOTO BY ERIC MORRIS

**Group III:** BIOL 246 Evolution; 381 Animal Behavior; 412 Ecology.  
**Environmental Electives:** BIOL 107 Environmental Biology

<sup>1</sup> Students may be asked to take MATH 117 and/or CHEM 101 if they do not place into MATH 131 Calculus I and/or CHEM 113.

<sup>2</sup> Minimum of 12 hours of free electives; MATH 132 and 231 and CHEM 214 Quantitative Analysis are recommended as electives, no more than 12 hours can be in Biology

<sup>3</sup> Math 117 is not required for those who place into MATH 131. MATH 131 and 201 are required to fulfill the requirements for Math.

<sup>4</sup> Minimum of 30 hours of Biology electives must be selected at or above the 300 level; including at least one course from each of the 4 groups listed on P. 99, except BIOL 217 and 218 must be taken together. The maximum number of biology hours is 61 unless the excess is added to the 122 minimum credits needed for graduation.

<sup>5</sup> Moral Values electives: Choose a Philosophy course except Logic.

**COURSE REQUIREMENTS FOR B.S. IN CHEMISTRY**

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CHEM 113 Prin of Chemistry I .....	3	CHEM 114 Prin of Chemistry II .....	3
CHEM 113L Prin of Chem I Lab .....	1	CHEM 114L Prin of Chem II Lab .....	1
ENG 111 English Composition I .....	3	ENG 112 English Composition II .....	3
MATH 131 Calculus I .....	3	MATH 132 Calculus II .....	3
Religious Studies Elective .....	3	Moral Values Elective .....	3
Social Science Elective .....	3	Free Elective .....	3
Orientation .....	0		
<b>Total .....</b>	<b>16</b>	<b>Total .....</b>	<b>16</b>

<b>SOPHOMORE YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CHEM 211 Organic Chemistry I .....	3	CHEM 212 Organic Chemistry II .....	3
CHEM 211L Organic Chem I Lab .....	1	CHEM 212L Organic Chem II Lab .....	1
ENG 211 Intro to Literature I <sup>1</sup> .....	3	CHEM 214 Quantitative Analysis .....	2
MATH 231 Differential Equations .....	3	CHEM 214L Quant Analysis Lab .....	2
PHYS 150 Physics I .....	3	MATH 232 Calculus III .....	3
PHYS 150L Physics I Lab .....	1	PHYS 251 Physics II .....	3
Free Elective .....	3	PHYS 251L Physics II Lab .....	1
<b>Total .....</b>	<b>17</b>	<b>Total .....</b>	<b>15</b>

<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CHEM 351 Physical Chemistry .....	3	CHEM 352 Physical Chemistry II .....	3
CHEM 351L Physical Chem I Lab .....	1	CHEM 352L Physical Chem II Lab .....	1
MATH Elective .....	3	CHEM 415 Analytical Chemistry .....	3
PHYS 252 Physics III .....	3	CHEM 415L Analytical Chem Lab .....	1
PHYS 252L Physics III Lab .....	1	Foreign Language II .....	3
Foreign Language I .....	3	ENG 212 Intro to Literature II <sup>1</sup> .....	3
<b>Total .....</b>	<b>14</b>	<b>Total .....</b>	<b>14</b>

<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CHEM 312 Biochemistry .....	3	CHEM 422 Inorganic Chemistry .....	3
CHEM 312L Biochemistry Lab .....	1	CHEM 422L Inorganic Chemistry Lab .....	1
CHEM 430 Research Seminar I .....	0	CHEM 431 Research Seminar II .....	2
Social Science Elective .....	3	Chemistry Elective (UD) .....	3
Religious Studies Elective .....	3	Free Electives .....	6
Business/Tech Elective .....	3		
Free Electives .....	2		
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>15</b>

**Total credits required for the degree: 122.**

The maximum number of credits in chemistry applicable to the degree is 52 hours.

Transfer students must take at least 15 hours of the required Chemistry courses numbered at or above the 300 level at Christian Brothers University

MATH 101, MATH 117, ENG 100, and CHEM 101 do not fulfill the free electives requirement.

<sup>1</sup> ENG 221 and 222 may be substituted.

**COURSE REQUIREMENTS FOR B.S. IN CHEMISTRY (PRE-MED)**

<b>FRESHMAN YEAR Semester I Credits</b>		<b>Semester II Credits</b>	
CHEM 113 Prin of Chem I & Lab .....	4	CHEM 114 Prin of Chem II & Lab .....	4
BIOL 111 Prin of Biology I & Lab .....	4	BIOL 112 Prin of Biology II & Lab .....	4
ENG 111 English Composition I .....	3	ENG 112 English Composition II .....	3
MATH 131 Calculus I .....	3	MATH 132 Calculus II .....	3
Orientation .....	0	Religious Studies Elective.....	3
<b>Total .....</b>	<b>14</b>	<b>Total.....</b>	<b>17</b>

<b>SOPHOMORE YEAR Semester I Credits</b>		<b>Semester II Credits</b>	
CHEM 211 Organic Chem I & Lab .....	4	BIOL 218 Anatomy/Physiology II .....	3
BIOL 217 Anatomy/Physiology I .....	3	CHEM 212 Organic Chem II & Lab .....	4
MATH 231 Differential Equations .....	3	CHEM 214 Quantitative Analysis .....	2
PHYS 150 Physics I .....	3	CHEM 214L Quant Analysis Lab .....	2
PHYS 150L Physics I Lab .....	1	MATH 232 Calculus III .....	3
		PHYS 251 Physics II .....	3
		PHYS 251L Physics II Lab .....	1
<b>Total .....</b>	<b>14</b>	<b>Total.....</b>	<b>18</b>

<b>JUNIOR YEAR Semester I Credits</b>		<b>Semester II Credits</b>	
CHEM 351 Physical Chem I & Lab .....	4	CHEM 352 Physical Chem II & Lab .....	4
MATH 308 Statistics .....	3	CHEM 415 Analytical Chem & Lab .....	4
ENG 211 Intro to Literature I <sup>1</sup> .....	3	ENG 212 Intro to Literature II <sup>1</sup> .....	3
PHYS 252 Physics III .....	3	Business/Tech Elective .....	3
PHYS 252L Physics III Lab .....	1	Foreign Language II .....	3
Foreign Language I .....	3		
<b>Total .....</b>	<b>17</b>	<b>Total.....</b>	<b>17</b>

<b>SENIOR YEAR Semester I Credits</b>		<b>Semester II Credits</b>	
CHEM 312 Biochemistry & Lab .....	4	CHEM 422 Inorganic Chemistry .....	3
CHEM 430 Research Seminar I .....	0	CHEM 422L Inorganic Chem Lab.....	1
Religious Studies Elective.....	3	CHEM 431 Research Seminar II .....	2
Social Science Elective .....	3	Chemistry Elective (UD) .....	3
Moral Values Elective .....	3	Social Science Elective .....	3
<b>Total .....</b>	<b>13</b>	<b>Total.....</b>	<b>12</b>

**Total credits required for the degree: 122.**

A maximum of 52 hours in chemistry are applicable to the degree.

Transfer students must take at least 15 hours of the required Chemistry courses numbered at or above the 300 level at Christian Brothers University

MATH 101, MATH 117, ENG 100, and CHEM 101 do not fulfill the free electives requirement. **Recommended for some Pharmacy Schools:** BIOL 217L Anatomy/Physiology Lab I and 218L, Anatomy/Physiology Lab II; BIOL 321 AND 321L Microbiology Lab in Fall, Senior Year and BIOL 415 and 415L Immunology and Immunology Lab in Spring, Senior Year for a total of ten more hours.

<sup>1</sup> ENG 221 and 222 may be substituted.

**COURSE REQUIREMENTS FOR B.S. IN COMPUTER SCIENCE**

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
ENG 111 English Composition I .....	3	CS 122 Foundations of CS I & Lab .....	4
CS 109 Intro to CS .....	3	ENG 112 English Composition II .....	3
MATH 117 Precalculus .....	3	MATH 131 Calculus I .....	3
Religious Studies Elective .....	3	Social Science Elective <sup>1</sup> .....	3
Social Science Elective <sup>1</sup> .....	3	Religious Studies Elective .....	3
Orientation .....	0		
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>16</b>

<b>SOPHOMORE YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CS 234 Foundations CS II & Lab .....	4	CS 236 Object Oriented Design .....	3
MATH 132 Calculus II .....	3	MATH 141 Discrete Mathematics .....	3
ECE 250 Digital Design .....	3	PHYS 251 Physics II .....	3
PHYS 150 Physics I .....	3	PHYS 251L Physics II Lab .....	1
PHYS 150L Physics I Lab .....	1	ENGR/IS Option .....	6
ENGR/IS Option .....	3		
<b>Total .....</b>	<b>17</b>	<b>Total .....</b>	<b>16</b>

<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CS 392 Database Design .....	3	CS 380 Operating Systems .....	3
ENGR/IS Option .....	3	CS 400 Internship .....	3
Philosophy Elective <sup>2</sup> .....	3	ECE 450 Computer Networks .....	3
Literature Elective .....	3	ENGR/IS Option .....	3
Minor Elective <sup>3</sup> .....	3	Minor Elective <sup>3</sup> .....	3
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>15</b>

<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CS 481 Project I .....	1	CS 460 Topics in CS .....	3
ENGR/IS Option .....	9	CS 482 Project II .....	3
Minor Elective <sup>3</sup> .....	3	CS 440 Algorithms .....	3
		ENGR/IS Option .....	3
		Minor Electives <sup>3</sup> .....	3
<b>Total .....</b>	<b>13</b>	<b>Total .....</b>	<b>15</b>

**Total credits required for degree: 122.**

A maximum of 47 credits in Computer Science is applicable toward the degree.

Transfer students must take at least one half of the required computer related courses numbered 300 or above at Christian Brothers University.

**Engineering Option:** required courses are ECE 221, 251, 350; MATH 231; two from ECE 451, 453, 454, 456, 457, and 480-489 Special Topics.

**Information Systems Option:** required courses are ECON 212; ITM 351, 455, 457, 480; MGMT 337 and MKTG 311.

<sup>1</sup> Six hours of Social Sciences must be in the same field whether it is History, Political Science, Psychology, or Sociology.

<sup>2</sup> Must satisfy the moral values requirement

<sup>3</sup> A minor is required. The minor may not be in Computer Engineering, Computer Science, or Information Technology Management.

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**COURSE REQUIREMENTS FOR B.S. IN COMPUTER SCIENCE &  
B.S. IN MATHEMATICS**

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
ENG 111 English Composition I .....	3	ENG 112 English Composition II .....	3
MATH 131 Calculus I .....	3	MATH 132 Calculus II .....	3
CS 109 Intro to CS .....	3	CS 122 Foundations of CS I & Lab .....	4
Religious Studies Elective .....	3	PHYS 150 Physics I .....	3
Social Science Elective <sup>1</sup> .....	3	PHYS 150L Physics I Lab .....	1
Orientation .....	0	Religious Studies Elective .....	3
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>17</b>

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<b>SOPHOMORE YEAR Semester I Credits</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CS 234 Foundations of CS II & Lab .....	4	CS 236 Objects Oriented Design .....	3
MATH 231 Differential Equations .....	3	MATH 232 Calculus III .....	3
PHYS 251 Physics II .....	3	ECE 251 Microprocessor Architecture .....	3
PHYS 251L Physics II Lab .....	1	ENG Literature Elective .....	3
ECE 221 Circuit I .....	3	Social Science Elective .....	3
ECE 250 Digital Design .....	3	<b>Total .....</b>	<b>15</b>
<b>Total .....</b>	<b>17</b>		

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<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CS 392 Database Design .....	3	CS 380 Operating Systems .....	3
MATH 401 Linear Algebra .....	3	CS 400 Internship .....	3
MATH 329 Applied Numerical Analysis .....	3	ECE 450 Computer Networks .....	3
MATH Elective .....	3	MATH 402 Abstract Algebra .....	3
ECE 350 Systems Architecture .....	3	MATH 414 Real Analysis .....	3
<b>Total .....</b>	<b>15</b>	MATH 405 Discrete Math .....	3
		<b>Total .....</b>	<b>18</b>

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<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
MATH 413 Complex Analysis .....	3	CS 440 Algorithms .....	3
MATH 481 Math Seminar I .....	1	MATH 482 Math Seminar II .....	2
CS 481 Computer Science Project I .....	1	CS 482 Computer Sciencs Project II .....	3
Philosophy Elective .....	3	Foreign Language .....	3
Foreign Language .....	3	ECE Elective .....	3
ECE Elective .....	3	CS 460 Topics in CS .....	3
<b>Total .....</b>	<b>14</b>	<b>Total .....</b>	<b>17</b>

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**Total credits for degree: 128.**

MATH 482 & CS 482 can be met by a single project if the student's project has both significant Math and CS content in it.

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**COURSE REQUIREMENTS FOR B.S. IN ENGINEERING PHYSICS**

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
ENG 111 English Comp I .....	3	CHEM 115 Gen Chemistry .....	3
ECE 112/ME 112 Computers in Engr .....	3	CHEM 115L Gen Chemistry Lab .....	1
MATH 131 Calculus I .....	3	ENG 112 English Comp II .....	3
ME 112 Solids Modeling .....	3	MATH 132 Calculus II .....	3
Elective .....	3	PHYS 150 Physics I .....	3
Orientation .....	0	PHYS 150L Physics I Lab .....	1
		Free Electives .....	2
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>16</b>

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<b>SOPHOMORE YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
ECE 201 Engr Instrumentation .....	2	ECE 222 Circuit Analysis II .....	3
ECE 221 Circuit Analysis I .....	3	MATH 232 Calculus III .....	3
MATH 231 Differential Equations .....	3	ME 305 Thermodynamics I .....	3
PHYS 251 Physics II .....	3	PHYS 252 Physics III .....	3
PHYS 251L Physics II Lab .....	1	Religious Studies Elective .....	3
Literature Elective .....	3		
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>15</b>

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<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
ECE 331 Electronics I .....	3	Engineering Elective <sup>1</sup> .....	3
ECE 341 Junior Lab .....	2	ENGR/PHYS/MATH Elective <sup>1</sup> .....	3
PHYS 252L Physics III Lab .....	1	PHYS 347 Special Relativity .....	1
PHYS 353 Solid State Physics .....	3	Moral Values Elective .....	3
PHYS 380 Advanced Mech .....	3	Social Science Elective <sup>2</sup> .....	3
PHYS 447 Modern Physics .....	3	Elective .....	3
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>16</b>

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<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
MATH 309 Probability .....	3	PHYS 416 Phys Optics II .....	3
PHYS 337/ECE 406 E & M Fields .....	4	PHYS 416L Phys Optics II Lab .....	1
PHYS 415 Phys Optics I .....	3	PHYS 452 Advanced Phys Lab .....	1
PHYS 415L Phys Optics I Lab .....	1	PHYS 492 Research II .....	2
PHYS 491 Research I .....	0	PHYS 499 Comprehensives .....	0
Religious Studies Elective .....	3	Engineering Elective <sup>1</sup> .....	3
		Social Science Elective <sup>2</sup> .....	3
		Elective .....	3
<b>Total .....</b>	<b>14</b>	<b>Total .....</b>	<b>16</b>

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**Total credits for degree: 122.**

Transfer students must take at least one-half of the required courses numbered above 300 at CBU.

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<sup>1</sup> Engineering electives must be numbered 300 or above and can be from any field of engineering but must be approved by the Physics Department.

<sup>2</sup> The two social science electives must be in the same field.

**COURSE REQUIREMENTS FOR B.A. IN MATHEMATICS**

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
ENG 111 English Composition I .....	3	ENG 112 English Composition II .....	3
MATH 131 Calculus I .....	3	MATH 132 Calculus II .....	3
Foreign Language <sup>1</sup> .....	3	Business/Technology Elective <sup>6</sup> .....	3
History Elective .....	3	Foreign Language <sup>1</sup> .....	3
Religious Studies Elective .....	3	History Elective .....	3
Orientation .....	0		
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>15</b>

<b>SOPHOMORE YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
Literature Elective .....	3	Literature Elective .....	3
MATH 231 Differential Equations .....	3	MATH 141 Discrete Mathematics .....	3
Foreign Language <sup>1</sup> .....	3	MATH 232 Calculus III .....	3
Religious Studies Elective .....	3	Foreign Language <sup>1</sup> .....	3
Science Elective <sup>2</sup> .....	4	Science Elective <sup>2</sup> .....	4
<b>Total .....</b>	<b>16</b>	<b>Total .....</b>	<b>16</b>

<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
MATH 401 Linear Algebra .....	3	CS 122 or ECE 112 Comp. Science <sup>4</sup> ... 3-4	
Mathematics Elective <sup>3</sup> .....	3	MATH 402 Abstract Algebra .....	3
Philosophy Elective .....	3	Mathematics Elective <sup>3</sup> .....	3
Liberal Arts Elective <sup>5</sup> .....	3	Philosophy Elective .....	3
Electives .....	3	Liberal Arts Elective <sup>5</sup> .....	3
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>15-16</b>

<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
MATH 413 Complex Analysis .....	3	MATH 414 Real Analysis .....	3
MATH 481 Seminar I .....	1	MATH 482 Seminar II .....	2
Mathematics Elective <sup>3</sup> .....	3	Electives .....	9
Electives .....	9		
<b>Total .....</b>	<b>16</b>	<b>Total .....</b>	<b>14</b>

**Total credits required for the degree: 122.**

A maximum of 47 credits in mathematics is applicable toward the degree.

Transfer students must take at least one half of the required mathematics courses numbered above 300 at Christian Brothers University.

<sup>1</sup> A minimum of 12 credits in a modern foreign language is required.

<sup>2</sup> The required science electives must be from only one of these fields: Biology, Chemistry or Physics.

<sup>3</sup> The mathematics electives must be chosen from MATH 301, 308, 309, 329, 405, or 470-479.

<sup>4</sup> CS 122 and ECE 112 are the same subject. If CS 122 is chosen, reduce free electives by 1 credit.

<sup>5</sup> A total of 51 credits in the Arts must be distributed in such a way that 12 credits are in one of the Social Sciences or Philosophy or Religious Studies.

<sup>6</sup> Selected from ECON 211, 212, CS 109 or any Engineering course. Students who plan to take CS 122 should take CS 109.

**COURSE REQUIREMENTS FOR B.S. IN MATHEMATICS**

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
ENG 111 English Composition I .....	3	ENG 112 English Composition II .....	3
MATH 131 Calculus I .....	3	MATH 132 Calculus II .....	3
Foreign Language .....	3	Foreign Language .....	3
Religious Studies Elective .....	3	Science Elective <sup>1</sup> .....	4
Social Science Elective .....	3	Social Science Elective .....	3
Orientation .....	0		
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>16</b>

<b>SOPHOMORE YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
ENG Literature Elective .....	3	CS 122 (L) or ECE 112 Comp. Science <sup>5</sup> .....	3-4
MATH 231 Differential Equations .....	3	ENG Literature Elective .....	3
ENGR Elective / CS 109 Intro Comp Sci <sup>2</sup> .....	3	MATH 141 Discrete Mathematics .....	3
Philosophy Elective <sup>6</sup> .....	3	MATH 232 Calculus III .....	3
Science Elective <sup>1</sup> .....	4	Minor Elective <sup>3</sup> .....	4
<b>Total .....</b>	<b>16</b>	<b>Total .....</b>	<b>16-17</b>

<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
MATH 401 Linear Algebra .....	3	MATH 402 Abstract Algebra .....	3
Mathematics Elective <sup>4</sup> .....	3	Mathematics Elective <sup>4</sup> .....	3
Minor Electives <sup>3</sup> .....	7	Religious Studies Elective .....	3
Elective .....	3	Minor Electives <sup>3</sup> .....	4
<b>Total .....</b>	<b>16</b>	<b>Total .....</b>	<b>13</b>

<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
MATH 413 Complex Analysis .....	3	MATH 414 Real Analysis .....	3
MATH 481 Seminar I .....	1	MATH 482 Seminar II .....	2
Mathematics Elective <sup>4</sup> .....	3	Minor Electives <sup>3</sup> .....	3
Minor Electives <sup>3</sup> .....	4	Electives .....	6
Electives .....	5		
<b>Total .....</b>	<b>16</b>	<b>Total .....</b>	<b>14</b>

**Total credits required for the degree: 122.**

A maximum of 47 credits in mathematics is applicable toward the degree.

Transfer students must take at least one half of the required mathematics courses numbered above 300 at Christian Brothers University.

<sup>1</sup> Science electives must include at least 8 hours in one of Biology, Chemistry, or Physics outside the area chosen for the minor.

<sup>2</sup> Students who will take CS 122 should take CS 109. If a 2 credit engineering course is taken, add an additional credit to free electives.

<sup>3</sup> Minor electives must be chosen to obtain a minor in one of Biology, Chemistry, Computer Science, or Physics. Credits necessary for the minor vary with the requirements for that minor. Reduce free electives by the difference of those credits required by the chosen minor and those listed as minor elective credits in this paradigm.

<sup>4</sup> The Mathematics electives must be chosen from MATH 301, 308, 309, 329, 405, or 470-479.

<sup>5</sup> CS 122 and ECE 112 are the same subject. If CS 122 is chosen, reduce free electives by 1 credit.

<sup>6</sup> Must satisfy moral values requirement.

**COURSE REQUIREMENTS FOR B.S. IN NATURAL SCIENCE**

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
BIOL 111 Prin of Biology I <sup>1</sup> .....	3	BIOL 112 Prin of Biology II <sup>1</sup> .....	3
BIOL 111L Prin of Biology I Lab <sup>1</sup> .....	1	BIOL 112L Prin of Biology II Lab <sup>1</sup> .....	1
CHEM 113 Prin of Chemistry I .....	3	CHEM 114 Prin of Chemistry II .....	3
CHEM 113L Prin of Chem I Lab .....	1	CHEM 114L Prin of Chem II Lab .....	1
ENG 111 English Comp I .....	3	ENG 112 English Comp II .....	3
MATH 117/131 .....	3	MATH 106/131/132 .....	3
Orientation .....	0		
<b>Total .....</b>	<b>14</b>	<b>Total .....</b>	<b>14</b>

<b>SOPHOMORE YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
Science Area I <sup>2</sup> .....	4	Science Area I .....	4
PHYS 150/201 Physics I <sup>3</sup> .....	3	PHYS 251/202 Physics II <sup>3</sup> .....	3
PHYS 150L/201L Physics I Lab <sup>3</sup> .....	1	PHYS 251L/202L Physics II Lab <sup>3</sup> .....	1
Computer Technology Elective .....	3	Moral Values Elective .....	3
Literature Elective .....	3	Social Science Elective .....	3
Social Science Elective .....	3		
<b>Total .....</b>	<b>17</b>	<b>Total .....</b>	<b>14</b>

<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
Science Area I .....	4	Science (Any Area) .....	3
Science (Any Area) .....	3	Religious Studies Elective .....	3
Religious Studies Elective .....	3	Electives .....	9
Electives .....	6		
<b>Total .....</b>	<b>16</b>	<b>Total .....</b>	<b>15</b>

<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
NSCI 410 Senior Thesis I .....	1	NSCI 411 Senior Thesis II .....	1
Science (Any Area) .....	3	Science (Any Area) .....	3
Electives .....	12	Electives .....	12
<b>Total .....</b>	<b>16</b>	<b>Total .....</b>	<b>16</b>

**Total credits for degree: 122.**

Transfer students must take at least one-half of the required courses numbered at or above the 200 level at CBU, and this must include at least two courses (6 to 8 hours excluding NSCI 410, 411) at or above the 300 level.

CHEM 101 does not supply any credit for Major Requirements. It can supply 3 credit hours of Free Electives.

<sup>1</sup> Students who choose Physics as Science Area I can take BIOL 109 and 109L instead of BIOL 111, 111L, 112, and 112L.

<sup>2</sup> Students must have at least 26 hours of science (biology, chemistry, or physics) at or above the 200+ level. At least 12 of these 26 hours must be in the same field (Science Area I). At least 8 of these 26 hours must be at the 300+ level (including NSCI 410 & 411).

<sup>3</sup> Students who choose Physics as Science Area I must take PHYS 150, 251, 252 and the associated labs.

**COURSE REQUIREMENTS FOR B.S. IN PHYSICS**

<b>FRESHMAN YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
CHEM 113 Prin of Chemistry I .....	3	CHEM 114 Prin of Chemistry II .....	3
CHEM 113L Prin of Chem Lab I .....	1	CHEM 114L Prin of Chem II Lab .....	1
ENG 111 English Comp I .....	3	ENG 112 English Comp II .....	3
ECE 112/ME 112 Computers in Engr. ....	3	MATH 132 Calculus II .....	3
MATH 131 Calculus I .....	3	PHYS 150 Physics I .....	3
Religious Studies Elective .....	3	PHYS 150L Physics I Lab .....	1
ORIN 100 Orientation .....	0		
<b>Total .....</b>	<b>16</b>	<b>Total .....</b>	<b>14</b>

<b>SOPHOMORE YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
ECE 201 Engr Instrumentation .....	2	MATH 232 Calculus III .....	3
ECE 221 Circuit Analysis I .....	3	PHYS 252 Physics III .....	3
MATH 231 Differential Equations .....	3	Literature or Philosophy Elective .....	3
PHYS 251 Physics II .....	3	Moral Values Elective .....	3
PHYS 251L Physics II Lab .....	1	Elective <sup>1</sup> .....	3
Literature Elective .....	3		
<b>Total .....</b>	<b>15</b>	<b>Total .....</b>	<b>15</b>

<b>JUNIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
MATH 309 Probability .....	3	PHYS 347 Special Relativity .....	1
PHYS 252L Physics III Lab .....	1	PHYS 460 Theoretical Physics .....	3
PHYS 353 Solid State Physics .....	3	Religious Studies Elective .....	3
PHYS 380 Advanced Mechanics .....	3	Social Science Elective <sup>3</sup> .....	3
PHYS 447 Modern Physics .....	3	Math Modeling Elective <sup>4</sup> .....	3
Thermodynamics Elective <sup>2</sup> .....	3-4	Mathematics Elective <sup>4</sup> .....	3
<b>Total .....</b>	<b>16-17</b>	<b>Total .....</b>	<b>16</b>

<b>SENIOR YEAR Semester I</b>	<b>Credits</b>	<b>Semester II</b>	<b>Credits</b>
PHYS 337/ECE 406 E & M Fields .....	4	PHYS 416 Phys Optics II .....	3
PHYS 415 Phys Optics I .....	3	PHYS 416L Phys Optics II Lab .....	1
PHYS 415L Phys Optics I Lab .....	1	PHYS 452 Advanced Phys Lab .....	1
PHYS 491 Research I .....	0	PHYS 492 Research II .....	2
Mathematics Elective <sup>4</sup> .....	3	PHYS 499 Comprehensives .....	0
Elective <sup>1</sup> .....	3	Mathematics Elective <sup>4</sup> .....	3
		Social Science Elective <sup>3</sup> .....	3
		Elective <sup>1</sup> .....	2-3
<b>Total .....</b>	<b>14</b>	<b>Total .....</b>	<b>15-16</b>

**Total credits for degree: 122.**

Transfer students must take at least one-half of the required courses numbered above 300 at CBU.

<sup>1</sup> A maximum of 3 elective hours may be in physics.

<sup>2</sup> Choose either ME 305: Thermodynamics I (3 credits) or CHEM 351 & 351L: Physical Chemistry I & Lab (4 credits).

<sup>3</sup> Two social science electives are required and must be in the same field.

<sup>4</sup> All mathematics electives must be at the 300+level.

## MINORS IN THE SCHOOL OF SCIENCES

At least 50% of required courses for a minor must be taken at CBU.

**MINOR IN BIOLOGY:** A minor in Biology requires BIOL 111 and BIOL 112 and laboratory corequisites plus 15 hours in BIOL courses numbered 200 or above including 7 hours in BIOL courses numbered 300 and above and earned at CBU.

**MINOR IN CHEMISTRY:** A minor in Chemistry requires a minimum of 23 hours in CHEM courses excluding CHEM 101, 115, and 115L. At least 7 of the hours must be in CHEM courses numbered 300 or above and earned at CBU.

**MINOR IN COMPUTER SCIENCE:** A minor in Computer Science requires the following courses CS 122, 122L, 234, 234L, 236, 392; MATH 141 or 405; and one course selected from CS 385, 440, 460-469.

**MINOR IN MATHEMATICS:** A minor in Mathematics requires 21 hours in MATH courses including MATH 131, 132, 231, 232, and three MATH courses numbered 300 or above. At least 6 hours in MATH courses numbered 300 or above must be earned at CBU.

**MINOR IN PHYSICS:** A minor in Physics requires the following courses: PHYS 150, 150L, 251, 251L, 252, 252L, and at least 9 hours in PHYS courses numbered 300 or above. At least 5 hours in PHYS courses numbered 300 or above must be earned at CBU, and no more than 4 hours in PHYS courses numbered 300 or above may be earned via challenge exams.



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