

SCHOOL OF SCIENCES

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

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FACULTY

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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)

CHEMISTRY

WILLIAM J. BUSLER, *Professor*

B.S., Christian Brothers College;

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

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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, *Associate Professor*

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

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

MATHEMATICS/COMPUTER SCIENCEMIGUEL B. ARELLANO, *Assistant Professor*

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

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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 University

PASCAL BEDROSSIAN, *Professor*

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 University

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

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B.A., University of St. Thomas; M.S., University of Notre Dame;

Ph.D., University of Illinois

ARTHUR A. YANUSHKA, *Professor*

B.A., Fordham University; M.S., State University of New York at Stony Brook;

Ph.D., University of Illinois

PHYSICS/NATURAL SCIENCEJOHNNY B. HOLMES, *Professor*

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

JOHN 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, FSC

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

LYLE D. WESCOTT, JR.

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

PART-TIME FACULTYBROTHER JOHN MONZYK, C.P., *Assistant Professor*

B.A., Bellarmine College; M.A., Catholic Theological Union;

M.S., Ph.D., Southern Illinois University

BROTHER KEVIN MALACHY RYAN, FSC, *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, Biomedical Science, 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, Biomedical Science, 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 112 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 93 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. 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.

FRESHMAN YEAR Semester I	Credits	Semester II	Credits
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
IDS 101 Dimensions of Faith and Community.....	3	MATH 131 Calculus I.....	3
Elective ^{1,2}	3	Business/Tech Elective.....	3
Orientation.....	0		
Total.....	17	Total.....	17

SOPHOMORE YEAR Semester I	Credits	Semester II	Credits
Biology Elective & Lab ³	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
Religious Studies (200 level).....	3	Biology Elective & Lab.....	4
		Social Science Elective.....	3
Total.....	15	Total.....	16

JUNIOR YEAR Semester I	Credits	Semester II	Credits
BIOL 311 Genetics & Lab.....	4	BIOL 362 Biology Seminar.....	1
MATH 201 Applied Statistics.....	3	Biology Elective & Lab.....	4
Chemistry ⁴	4	Biology Elective & Lab.....	4
Literature Elective.....	3	Religious Studies (300 Level).....	3
		Moral Values Elective.....	3
Total.....	14	Total.....	15
Summer: BIOL 463 Research I ⁵	1		

SENIOR YEAR Semester I	Credits	Semester II	Credits
BIOL 464 Research ⁵	2	BIOL 465 Research III ⁵	2
Biology Elective & Lab.....	4	Biology Elective & Lab.....	4
Biology Elective.....	3	Biology Elective.....	3
Elective.....	3	Social Science Elective.....	3
BIOL 499 Senior Comprehensive.....	0	Elective.....	3
Total.....	12	Total.....	15

Minimum total number of credits for graduation: 122.

SEE NOTES ON FOLLOWING PAGE.

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; 236 Nutrition; BIOL 312 Vertebrate Physiology; 414 Histology; 451 Neuroscience.

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

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

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

¹ Students may be asked to take MATH 117 and/or CHEM 101 if they do not place into MATH 131 and/or CHEM 113

² Minimum of 9 hours of free electives; no more than 6 hours can be in Biology unless the minimum exceeds 122 hours.

³ Minimum of 30 hours of biology electives must include at least one course from each of the four groups listed above; minimum of 20 hours of biology electives must be at or above the 300 level.

⁴ Recommended: CHEM 312 or 315-316 Biochemistry or CHEM 214 Quantitative Analysis; any chemistry course with a lab at the 200 level or above will satisfy the requirement.

⁵ Substitute BIOL 461-462 only with permission of the Chair or Course Director. Students who take BIOL 461 and 462 Independent Research will have to make up three credits in biology in order to complete the 122 hours required minimum.

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.

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
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 Chemsitry II & Lab	4	
ENG 111 English Composition I	3		ENG 112 English Composition II	3	
IDS 101 Dimensions of Faith and Community	3		MATH 131 Calculus I	3	
Elective ^{1,2}	3		Business/Tech Elective	3	
Orientation	0				
Total.....	17		Total.....	17	

SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
Biology Elective & Lab ³	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	
Religious Studies (200 level).....	3		Biology Elective & Lab	4	
			Social Science Elective	3	
Total	15		Total.....	16	

JUNIOR YEAR Semester I		Credits	Semester II		Credits
BIOL 311 Genetics & Lab.....	4		BIOL 362 Biology Seminar	1	
MATH 201 Applied Statistics	3		Biology Elective & Lab	4	
Chemistry ⁴	4		Biology Elective & Lab	4	
Literature Elective	3		Religious Studies (300 Level)	3	
			Moral Values Elective.....	3	
Total	14		Total	15	

Summer: BIOL 463 Research I⁵..... 1

SENIOR YEAR Semester I		Credits	Semester II		Credits
BIOL 464 Research II ⁵	2		BIOL 465 Research III ⁵	2	
Biology Elective & Lab	4		Biology Elective & Lab.....	4	
Biology Elective	3		Biology Elective	3	
Elective	3		Elective.....	3	
BIOL 499 Biology Comprehensive	0		Social Science Elective	3	
Total.....	12		Total.....	15	

Minimum total number of credits for graduation: 122.

SEE NOTES ON FOLLOWING PAGE.

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 312 Vertebrate Physiology; 451 Neuroscience.

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

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

Recommended free electives: BIOL 107 Environmental Biology; CE 305 Environmental Site Assessment; CE 404 Solid and Hazardous Waste Management; CE 405 Remediation of Organically Contaminated Soil and Water; CE 406 Air Pollution; CHEM 214 Quantitative Analysis.

- ¹ 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.
- ² See the recommended free electives for environmental track students. No more than 6 hours can be in biology unless the excess is added to the 122 minimum credits for graduation.
- ³ Minimum of 30 hours of biology electives must include at least one course from each of the three groups previously listed; minimum of 20 hours of biology electives must be at or above the 300 level.
- ⁴ Recommended: CHEM 312 Biochemistry or 315 Biochemistry I and 316 Biochemistry II; or CHEM 214 Quantitative Analysis; any chemistry course with a lab at the 200 level or above will satisfy the requirement.
- ⁵ Substitute BIOL 461-462 only with permission of the Chair or Course Director. Students who take BIOL 461 and 462 Independent Research will have to make up three credits in biology in order to complete the 122 hours required minimum.

COURSE REQUIREMENTS FOR B.S. IN BIOMEDICAL SCIENCES

This paradigm applies to students who are seeking to enter medical, dental, or veterinary schools.

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
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	
IDS 101 Dimension of Faith and Community.....	3		MATH 131 Calculus I.....	3	
Elective ^{1,2}	3		Business/Tech elective.....	3	
Orientation.....	0				
Total.....	17		Total.....	17	
SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
BIOL 211 Embryology & Lab.....	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 & Lab.....	4		PHYS 202 Intro. Physics & Lab.....	4	
Literature elective.....	3		Biology elective & Lab ³	4	
			Social Sciences elective.....	3	
Total.....	15		Total.....	16	
JUNIOR YEAR Semester I		Credits	Semester II		Credits
BIOL 311 Genetics & Lab.....	4		BIOL 362 Biology Seminar.....	1	
MATH 201 Applied Statistics.....	3		BIOL 321 Micro. & Lab.....	4	
CHEM 315 Biochem. I & Lab.....	4		CHEM 316 Biochem. II.....	3	
BIOL 213 Vert. Phys. & Lab.....	4		PHIL 322 Medical Ethics.....	3	
			Religious Studies Elective.....	3	
Total.....	15		Total.....	14	
Summer: BIOL 463 Research I.....		1			
SENIOR YEAR Semester I		Credits	Semester II		Credits
BIOL 464 Research II.....	2		BIOL 465 Research III.....	2	
BIOL 413 Parasit. & Lab.....	4		BIOL 414 Histol. & Lab (or BIOL 321 & Lab).....	4	
Biology 415 Immunology & Lab.....	4		Biology elective ³	3	
Religious Studies elective.....	3		Elective.....	3	
BIOL 499 Comprehensive Exam.....	0		Social Science elective.....	3	
Total.....	13		Total.....	15	

Total number of credits for graduation: 123.

BIولوجY ELECTIVES

Group I: BIOL 211 Embryology; 218 Anatomy & Physiology II; 236 Nutrition; 451 Neuroscience.

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

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

Group IV: BIOL 367 Pharmacology; 415 Immunology; 421 Cell Biology.

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.

¹ Students may need to take MATH 117 and/or CHEM 101 if they do not place into MATH 131 and/or CHEM 113.

² Minimum of 6 hours of free electives; no more than 4 hours could be in biology unless the minimum exceeds 122 hours.

³ One biology elective must be taken from the Group III list

COURSE REQUIREMENTS FOR B.S. IN CHEMISTRY

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
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
IDS 101 Dimension of Faith and Community.....		3	Religious Studies Elective.....		3
Social Science Elective.....		3	Free Elective.....		3
Orientation.....		0			
Total.....		16	Total.....		16

SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
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 ¹		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
Total.....		17	Total.....		15

JUNIOR YEAR Semester I		Credits	Semester II		Credits
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
CHEM 330 Research Seminar.....		0	CHEM 415 Analytical Chemistry.....		3
Moral Values Elective.....		3	CHEM 415L Analytical Chemistry Lab.....		1
PHYS 252 Physics III.....		3	Math Elective.....		3
PHYS 252L Physics III Lab.....		1	Foreign Language II.....		3
Foreign Language I.....		3			
Total.....		14	Total.....		14

SENIOR YEAR Semester I		Credits	Semester II		Credits
CHEM 312 Biochemistry.....		3	CHEM 422 Inorganic Chemistry.....		3
CHEM 312L Biochemistry Lab.....		1	CHEM 422L Inorganic Chemistry Lab.....		1
Social Science Elective.....		3	CHEM 431 Research Seminar II.....		2
Religious Studies Elective.....		3	Chemistry Elective (UD).....		3
Free Electives.....		5	Free Electives.....		6
Total.....		15	Total.....		15

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 100, 101, 103, 117; ENG 100; and CHEM 101 do not fulfill the free electives requirement.

¹ ENG 212, 221, or 222 may be substituted.

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

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
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	
IDS 101 Dimensions of Faith and Community.....	3				
Total.....	17		Total.....	17	
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SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
CHEM 211 Organic Chem I & Lab.....	4		CHEM 212 Organic Chem II & Lab.....	4	
BIOL 211 Vertebrate Embryology and Lab.....	4		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	
			PHYS 251L Physics II Lab.....	1	
Total.....	15		Total.....	15	
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JUNIOR YEAR Semester I		Credits	Semester II		Credits
CHEM 351 Physical Chem I & Lab.....	4		CHEM 352 Physical Chem II & Lab.....	4	
CHEM 330 Research Seminar I.....	0		CHEM 415 Analytical Chem & Lab.....	4	
ENG 211 Intro to Literature I ¹	3		Math Elective.....	3	
PHYS 252 Physics III.....	3		Foreign Language II.....	3	
PHYS 252L Physics III Lab.....	1				
Foreign Language I.....	3				
Total.....	14		Total.....	14	
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SENIOR YEAR Semester I		Credits	Semester II		Credits
CHEM 312 Biochemistry & Lab.....	4		CHEM 422 Inorganic Chemistry.....	3	
Biology Elective.....	4		CHEM 422L Inorganic Chem Lab.....	1	
Religious Studies Elective.....	3		CHEM 431 Research Seminar II.....	2	
Social Science Elective.....	3		Chemistry Elective (UD).....	3	
Free Electives.....	1		Social Science Elective.....	3	
			Moral Values Elective.....	3	
Total.....	15		Total.....	15	

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 100, 101, 103, 117; ENG 100; and CHEM 101 do not fulfill the free electives requirement.

¹ ENG 212, 221, or 222 may be substituted.

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

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
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	
IDS 101 Dimensions of Faith and Community.....	3				
Total.....	17		Total.....	17	
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SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
CHEM 211 Organic Chem I & Lab.....	4		CHEM 212 Organic Chem II & Lab.....	4	
BIOL 217 Anatomy/Physiology I & Lab.....	4		CHEM 214 Quantitative Analysis & Lab.....	4	
MATH 231 Differential Equations.....	3		MATH 232 Calculus III.....	3	
PHYS 150 Physics I & Lab.....	4		PHYS 251 Physics II & Lab.....	4	
Total.....	15		Total.....	15	
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JUNIOR YEAR Semester I		Credits	Semester II		Credits
CHEM 351 Physical Chem I & Lab.....	4		CHEM 352 Physical Chem II & Lab.....	4	
CHEM 330 Research Seminar I.....	0		CHEM 415 Analytical Chem & Lab.....	4	
ENG 211 Intro to Literature I ¹	3		Math 308 Statistics.....	3	
PHYS 252 Physics III & Lab.....	4		Foreign Language II ²	3	
Foreign Language I ²	3				
Total.....	14		Total.....	14	
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SENIOR YEAR Semester I		Credits	Semester II		Credits
CHEM 312 Biochemistry & Lab.....	4		CHEM 422 Inorganic Chemistry & Lab.....	4	
Biology Elective.....	4		CHEM 431 Research Seminar II.....	2	
Religious Studies Elective.....	3		Chemistry Elective (UD).....	3	
Social Science Elective.....	3		Social Science Elective.....	3	
Moral Values Elective.....	3		Electives.....	1	
Total.....	17		Total.....	13	

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

Recommended for some Pharmacy Schools: Biology 218/218L (Anatomy/Physiology II), Biology 415 and Lab-Immunology, (Fall, Senior Year), Biology 321 and Lab-Microbiology (Spring, Senior Year). This can add 7 more hours to the degree.

MATH 100, 101, 103, 117; ENG 100; and CHEM 101 do not fulfill the free electives requirement.

¹ ENG 212, 221, or 222 may be substituted.

² Must be same language

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

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
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	
IDS 101 Dimensions of Faith and Community.....	3				
Total.....	17		Total.....	17	

SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
CHEM 211 Organic Chem I & Lab.....	4		CHEM 212 Organic Chem II & Lab.....	4	
SOC 101 Intro to Sociology.....	3		CHEM 214 Quantitative Analysis & Lab.....	4	
MATH 231 Differential Equations.....	3		MATH 232 Calculus III.....	3	
PHYS 150 Physics I & Lab.....	4		PHYS 251 Physics II & Lab.....	4	
Total.....	14		Total.....	15	

JUNIOR YEAR Semester I		Credits	Semester II		Credits
CHEM 351 Physical Chem I & Lab.....	4		CHEM 352 Physical Chem II & Lab.....	4	
CHEM 330 Research Seminar I.....	0		CHEM 415 Analytical Chem & Lab.....	4	
ENG 211 Intro to Literature I ¹	3		BIOL 321 Microbiology & Lab.....	4	
PHYS 252 Physics III & Lab.....	4		Math 308 Statistics.....	3	
Foreign Language I ²	3		Foreign Language II ²	3	
Total.....	14		Total.....	18	

SENIOR YEAR Semester I		Credits	Semester II		Credits
CHEM 312 Biochemistry & Lab.....	4		CHEM 422 Inorganic Chemistry & Lab.....	4	
BIOL 421 Cell/Mol. Biology & Lab.....	4		CHEM 431 Research Seminar II.....	2	
Religious Studies Elective.....	3		Chemistry Elective (UD).....	3	
Moral Values Elective.....	3		SOC 220 Social Justice and Services.....	3	
			Electives.....	1	
Total.....	14		Total.....	13	

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

Recommended Electives: Biology 217 & 218 Labs-Anatomy & Physiology Labs, Forensic Anthropology, Biology 414-Histology and Lab, and BIOL 415-Immunology and Lab.

¹ ENG 212, 221, or 222 may be substituted.

² Must be same language

COURSE REQUIREMENTS FOR B.S. IN COMPUTER SCIENCE

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
ENG 111 English Composition I.....	3		CS 172 Intermediate Prog & Lab.....	4	
CS 171 Intro to Programming & Algorithms.....	3		ENG 112 English Composition II.....	3	
MATH 131 Calculus.....	3		MATH 132 Calculus II.....	3	
IDS 101 Dimensions of Faith and Community.....	3		Social Science Elective ¹	3	
Social Science Elective ¹	3		Religious Studies Elective.....	3	
Orientation.....	0				
Total.....	15		Total.....	16	

SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
CS 234 Data Structures & Lab.....	4		CS 360 Object Oriented Design.....	3	
ECE 250 Digital Design.....	3		MATH 141 Discrete Mathematics.....	3	
PHYS 150/201 Physics I & Lab.....	4		PHYS 251/202 Physics II & Lab.....	4	
Option Elective.....	6		Option Elective.....	6	
Total.....	17		Total.....	16	

JUNIOR YEAR Semester I		Credits	Semester II		Credits
CS 471 Database Design.....	3		CS 370 Operating Systems.....	3	
Option Elective.....	6		CS 400 Internship.....	3	
Philosophy Elective ²	3		Option Elective.....	6	
CS 295 Data Communication.....	3		Literature Elective.....	3	
Total.....	15		Total.....	15	

SENIOR YEAR Semester I		Credits	Semester II		Credits
CS 481 Project I.....	1		CS 482 Project II.....	3	
Option Elective.....	9		CS 440 Algorithms.....	3	
Religious Studies Elective.....	3		Option Elective.....	6	
			Minor Elective.....	3	
Total.....	13		Total.....	15	

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.

Note: A minor is required in both the Engineering and Information Systems Options. The minor may not be in Computer Engineering, Computer Science, or Information Technology Management.

Bioinformatics Option: The minor for the Bioinformatics option must be either Biology or Chemistry. The minor in Biology includes BIOL 111, 111Lab, 112, 112Lab, 311, 311Lab, 321, 321Lab, 421, 421Lab. Other required courses are BIOL/CS 240; CHEM 113, 113Lab, 114, 114Lab, 211, 211Lab, 212, 212Lab. The minor in Chemistry includes CHEM 113, 113Lab, 114, 114Lab, 211, 211Lab, 212, 212Lab, 315, 315Lab, 316. Other required courses are BIOL/CS 240; BIOL 111, 111Lab, 112, 112Lab, 311, 311Lab.

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

Forensics Option: The minor for the Forensics option must be Biology which includes BIOL 111, 111L, 112, 112L, 217, 217Lab, 218, 218Lab, 321, 321Lab. Other required courses are MATH 201; CHEM 113, 113Lab, 114, 114Lab; ANTH 126, 126Lab, 301.

Information Systems Option: required courses are ECON 214; ITM 351, 455, 470, 480; MGMT 337 and MKTG 311.

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

² Must satisfy the moral values requirement

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

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
ENG 111 English Composition I.....	3		ENG 112 English Composition II.....	3	
MATH 131 Calculus I.....	3		MATH 132 Calculus II.....	3	
CS 171 Intro to Prog & Alg.....	3		CS 172 Intermediate Prog & Alg. & Lab.....	4	
IDS 101 Dimensions of Faith and Community.....	3		PHYS 150 Physics I.....	3	
Social Science Elective ¹	3		PHYS 150L Physics I Lab.....	1	
Orientation.....	0		Religious Studies Elective.....	3	
Total.....	15		Total.....	17	

SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
CS 234 Data Struct. & Lab.....	4		CS 360 Object Oriented Design.....	3	
MATH 231 Differential Equations.....	3		MATH 232 Calculus III.....	3	
PHYS 251 Physics II.....	3		CS 295 Data Communications.....	3	
PHYS 251L Physics II Lab.....	1		ECE 251 Microprocessor Architecture.....	3	
ECE 221 Circuit I.....	3		ENG Literature Elective.....	3	
ECE 250 Digital Design.....	3		Social Science Elective ¹	3	
Total.....	17		Total.....	18	

JUNIOR YEAR Semester I		Credits	Semester II		Credits
CS 471 Database Design.....	3		CS 370 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	
			MATH 405 Discrete Math.....	3	
Total.....	15		Total.....	18	

SENIOR YEAR Semester I		Credits	Semester II		Credits
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 ²	3		Foreign Language.....	3	
Foreign Language.....	3		ECE Elective.....	3	
ECE Elective.....	3		Religious Studies Elective.....	3	
Total.....	14		Total.....	17	

Total credits for degree: 131.

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

¹ Six hours of social science must be in the same field whether it is History, Political Science, Psychology, or Sociology.

² Must satisfy the moral values requirement.

COURSE REQUIREMENTS FOR B.S. IN ENGINEERING PHYSICS

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
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
IDS 101 Dimension of Faith and Community.....		3	PHYS 150 Physics I.....		3
Orientation.....		0	PHYS 150L Physics I Lab		1
Total		15	Total.....		14

SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
ECE 221 Circuit Analysis I.....		3	ECE 201 Engr Instrumentation		2
MATH 231 Differential Equations		3	ECE 222 Circuit Analysis II		3
PHYS 251 Physics II.....		3	MATH 232 Calculus III.....		3
PHYS 251L Physics II Lab.....		1	ME 305 Thermodynamics I.....		3
Literature Elective.....		3	PHYS 252 Physics III.....		3
Religious Studies Elective.....		3	Total.....		14
Total		16			

JUNIOR YEAR Semester I		Credits	Semester II		Credits
ECE 331 Electronics I.....		3	Engineering Elective ¹		3
ECE 341 Junior Lab		2	ENGR/PHYS/MATH Elective ¹		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 ²		3
PHYS 447 Quantum Mechanics.....		3	Elective.....		3
Total.....		15	Total.....		16

SENIOR YEAR Semester I		Credits	Semester II		Credits
MATH 309 Probability.....		3	PHYS 452 Advanced Phys Lab		2
PHYS 337/ECE 406 E & M Fields		4	PHYS 460 Theoretical Physics.....		3
PHYS 415/415L Optics & Lab.....		4	PHYS 492 Research II		2
PHYS 491 Research I		0	PHYS 499 Comprehensives.....		0
Religious Studies Elective.....		3	Engineering Elective ¹		3
Free Electives.....		2	Social Science Elective ²		3
Total.....		16	Elective.....		3
			Total.....		16

Total credits for degree: 122.

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

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

² The two social science electives must be in the same field.

COURSE REQUIREMENTS FOR B.S. IN MATHEMATICS

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
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 ¹		4
IDS 101 Dimensions of Faith and Community		3	Social Science Elective		3
Orientation		0			
Total		15	Total		16

SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
ENG Literature Elective.....		3	CS 172 & Lab or ECE 112 Comp. Science ²		3-4
MATH 231 Differential Equations		3	Elective.....		3
Social Science Elective		3	MATH 141 Discrete Mathematics		3
Philosophy Elective ⁶		3	MATH 232 Calculus III		3
Science Elective ¹		4	Minor Elective ³		4
Total.....		16	Total		16-17

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

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

Total credits required for the degree: 122.

SEE NOTES ON FOLLOWING PAGE.

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.

Forensics Option: The minor for Forensics option must be Biology which includes BIOL 111, 111Lab, 112, 112Lab, 217, 217Lab, 218, 218Lab, 321, 321Lab. Other required courses are CHEM 113, 113Lab, 114, 114Lab; 214, 214Lab; ANTH 126, 126Lab, 301.

Bioinformatics Option: The minor for the Bioinformatics option must be Biology which includes BIOL 111, 111Lab, 112, 112Lab, 311, 311Lab, 321, 321Lab, 421, 421Lab. Other required courses are BIOL/CS 240; CS 440; CHEM 113, 113Lab, 114, 114Lab, 211, 211Lab, 212, 212Lab.

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

² Students who will take CS 172 should take CS 171 first.

³ Minor electives must be chosen to obtain a minor in one of Bioinformatics, Biology, Chemistry, Computer Science, Forensics, 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.

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

⁵ Must satisfy moral values requirement.

COURSE REQUIREMENTS FOR B.A. IN MATHEMATICS

FRESHMAN YEAR Semester I		Credits	Semester II		Credits
ENG 111 English Composition I		3	ENG 112 English Composition II		3
MATH 131 Calculus I		3	MATH 132 Calculus II		3
Foreign Language ¹		3	Science Elective ²		4
IDS 101 Dimensions of Faith and Community		3	Foreign Language ¹		3
Religious Studies Elective		3	History Elective		3
Orientation		0			
Total		15	Total		16

SOPHOMORE YEAR Semester I		Credits	Semester II		Credits
Literature Elective		3	Literature Elective		3
MATH 231 Differential Equations		3	MATH 141 Discrete Mathematics		3
Foreign Language ¹		3	MATH 232 Calculus III		3
Religious Studies Elective		3	Foreign Language ¹		3
Science Elective ²		4	History Elective		3
Total		16	Total		15

JUNIOR YEAR Semester I		Credits	Semester II		Credits
MATH 401 Linear Algebra		3	CS 172 & Lab or ECE 112 Comp. Science ⁴		3-4
Mathematics Elective ³		3	MATH 402 Abstract Algebra		3
Philosophy Elective		3	Mathematics Elective ³		3
Liberal Arts Elective ⁵		3	Philosophy Elective		3
Electives		3	Liberal Arts Elective ⁵		3
Total		15	Total		15-16

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

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.

¹ A minimum of 12 credits in a modern foreign language is required.

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

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

⁴ Students who will take CS 172 should take CS 171 first.

⁵ 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, Philosophy, Religious Studies or History.

COURSE REQUIREMENTS FOR B.S. IN NATURAL SCIENCE

GENERAL EDUCATION REQUIREMENTS (See Page 31)	30 hours
Orientation (required for new freshmen)	0 hours
Interdisciplinary Studies (IDS 101)	3 hours
English Composition (ENG 111 & ENG 112)	6 hours
Mathematics (MATH 117)	3 hours
Literature Elective	3 hours
Religious Studies Electives	6 hours
Moral Values Elective	3 hours
Social Science Electives.....	6 hours
MAJOR SCIENCE REQUIREMENTS¹	50 hours
Principles of Biology (BIOL 111/111L & 112/112L) ²	8 hours
Principles of Chemistry (CHEM 113/113L & 114/114L) ³	8 hours
Physics (PHYS 201/201L & 202/202L or PHYS 150/150L & 251/251L) ⁴	8 hours
Science Electives	24 hours
Senior Research (NSCI 410 & 411)	2 hours
ADDITIONAL REQUIREMENTS	6 hours
Mathematics (131, if not previously taken; 106, or 132)	3 hours
Computer Technology Elective	3 hours
FREE ELECTIVES	36 hours
TOTAL HOURS FOR GRADUATION	122 hours

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.

General education, science, and free electives can be chosen to satisfy the following options.

Forensics Option: The following courses are recommended: ANTH 126/126L, 301; BIOL 217/217L, 218/218L 321/321L, 414/414L; CHEM 211/211L, 212/212L, 312/312L; MATH 201

Professional Writing Option: A certificate in professional writing is earned by taking four upper-level writing courses chosen from ENG 370, 371, 373, 375, 377, 376, 389.

Sales/Marketing Option: The following courses are recommended: MKTG 311, 334, 338, 348.

Teaching Licensure Option: Refer to the School of Arts section of the Catalog where paradigms for teaching licensure (grades 7-12) are listed. These paradigms are part of a five-year plan where the student earns a Master of Arts in Teaching.

¹ Students must have at least 26 hours of science (BIOL, CHEM, NSCI, or PHYS courses) 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).

² Students who choose Physics as Science Area I can take BIOL 109 & 109L instead of BIOL 111, 111L, 112 & 112L.

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

⁴ 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

FRESHMAN YEAR Semester I	Credits	Semester II	Credits
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
IDS 101 Dimensions of Faith and Community.....	3	PHYS 150L Physics I Lab.....	1
ORIN 100 Orientation.....	0		
Total.....	16	Total.....	14

SOPHOMORE YEAR Semester I	Credits	Semester II	Credits
Elective ¹	3	MATH 232 Calculus III.....	3
ECE 221 Circuit Analysis I.....	3	PHYS 252 Physics III.....	3
MATH 231 Differential Equations.....	3	Philosophy or Literature Elective.....	3
PHYS 251 Physics II.....	3	Moral Values Elective.....	3
PHYS 251L Physics II Lab.....	1	ECE 201 Engineering Instrumentation.....	2
Literature Elective.....	3		
Total.....	16	Total.....	14

JUNIOR YEAR Semester I	Credits	Semester II	Credits
MATH 309 Probability.....	3	PHYS 347 Special Relativity.....	1
PHYS 252L Physics III Lab.....	1	PHYS 448 Quantum Mechanics II.....	3
PHYS 353 Solid State Physics.....	3	Religious Studies Elective.....	3
PHYS 380 Advanced Mechanics.....	3	Social Science Elective ³	3
PHYS 447 Quantum Mechanics I.....	3	Math Modeling Elective ⁴	3
Thermodynamics Elective ²	3-4	Mathematics Elective ⁴	3
Total.....	16-17	Total.....	16

SENIOR YEAR Semester I	Credits	Semester II	Credits
PHYS 337/ECE 406 E & M Fields.....	4	PHYS 452 Advanced Phys Lab.....	2
PHYS 415/415L Optics & Lab.....	4	PHYS 460 Theoretical Physics.....	3
PHYS 491 Research I.....	0	PHYS 492 Research II.....	2
Mathematics Elective ⁴	3	PHYS 499 Comprehensives.....	0
Religious Studies Elective.....	3	Mathematics Elective ⁴	3
		Social Science Elective ³	3
		Elective ¹	2-3
Total.....	14	Total.....	15-16

Total credits for degree: 122.

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

¹ A maximum of 3 elective hours may be in physics.

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

³ Two Social Science electives are required and must be in the same field.

⁴ 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. See the information about the Bioinformatics Option and the Forensics Option on the pages associated with the B.S. in Computer Science and the B.S. in Mathematics.

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 380, 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.