# **B.S.M.A.S. IN MARINE SCIENCE / CHEMISTRY**

### **Overview**

The Marine Science/Chemistry degree is a Bachelor of Science degree (BSMAS) that is designed to give students a strong background in biogeochemical cycling of nutrients, the impact and fate of marine pollutants, marine geochemistry and ocean/atmosphere interactions.

Undergraduate students are encouraged to work with the faculty and are able to earn course credit by conducting independent research under the supervision of leading scientists in their field. Research at UM focuses on the role of ocean processes in carbon cycling and global climate change.

The Bachelor of Science double major in Marine Science/Chemistry prepares students for admission to graduate programs and for careers in teaching and research as well as for technical careers in government and private industries concerned with the oceans.

## **Curriculum Requirements**

Code	Title	Credit Hours
Marine Science Requirements		
MSC 111	Introduction to Marine Science	3
MSC 112	Introduction to Marine Science Lab	1
MSC 215	Chemical Oceanography	3
MSC 216	Chemical Oceanography Laboratory	1
MBE 230	Introduction to Marine Biology	3
MSC 301	Introduction to Physical Oceanography <sup>1</sup>	3
MBE 232	Introduction to Marine Biology Laboratory	1
or MSC 302	Introduction to Physical Oceanography Lab	
Select 6 credit hours of approved Rosenstiel School elective	ves within ATM, GSC, MBE, MSC, OCE or RSM courses <sup>2</sup>	6
MSC chemistry elective course from approved list <sup>3</sup>		3
Chemistry Requirements		
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
CHM 221	Introduction to Structure and Dynamics	4
CHM 205	Chemical Dynamics Laboratory	1
CHM 222	Organic Reactions and Synthesis	4
CHM 206	Organic Reactions and Synthesis Laboratory	2
CHM 214	Quantitative Analytical Chemistry	3
CHM 320	Instrumental Methods in Chemistry and Biochemistry	2
CHM 360	Physical Chemistry I (Lecture)	3
CHM 364	Physical Chemistry (Laboratory I)	1
CHM 365	Physical Chemistry II (Lecture)	3
CHM 401	Environmental Chemistry	3
CHM 441	Inorganic Chemistry (Lecture)	3
Select one of the following Chemistry electives:		3
CHM 316	Instrumental Analytical Chemistry	
CHM 317	The Chemistry of Food and Taste.	
Any 500-level Chemistry course as described for Chemis	stry BS majors	
Biochemistry and Molecular Biology Requirement		
BMB 401	Biochemistry for the Biomedical Sciences	4
Biology Requirements		
BIL 150	General Biology	5
& BIL 151	and General Biology Laboratory	
Geological Sciences Requirement <sup>5</sup>		3-4
Select one of the following:		
GSC 110	The Earth System	
GSC 111	Earth System History	
MSC 424	Origin and Geology of the Galapagos Islands. (Approval Required) $^{\rm 5}$	

or MTH 171         Calculus II (fulfills the Rosenstiel BSMAS quantitative skills requirement)         4           requirement)         Calculus II           requirement)         58C 204           ror MTH 224         Introduction to Probability and Statistics           corn MTH 224         Introduction to Probability and Statistics           corn MTH 224         Introduction to Probability and Statistics           corn MTH 224         Foundations of Computational Marine Science           cor CSC 120         Computer Programming I           Secure on ef the following options:         100           select one of the following options:         100           PHY 201         University Physics I for the Sciences           PHY 106         Physics Laboratory 1           PHY 201         Physics Laboratory 2           PHY 108         Physics Laboratory 2           PHY 210         University Physics II for the Sciences           PHY 221         University Physics II           PHY 222         University Physics II           PHY 223         University Physics II Lab           or PHY 225         University Physics II Lab           or PHY 226         University Physics II Lab           or PHY 227         Physics Preserver Writing II           or PHY 228         Ph	Mathematics Requirements		
ATH 162 Calculus II (fulfills the Rosenstiel BSMAS quantitative skills requirement)  or MTH 172 Calculus II  statistics Requirement  MSC 204 Environmental Statistics  or MTH 224 Introduction to Probability and Statistics  computational Science Requirement  MSC 203 Foundations of Computational Marine Science  or CSC 120 Computer Programming I  Physics Requirements  select one of the following options:  pHY 201 University Physics I for the Sciences  PHY 106 Physics Laboratory I  PHY 202 University Physics II for the Sciences  PHY 108 Physics Laboratory 2  PHY 221 University Physics II  PHY 222 University Physics II  PHY 223 University Physics II  PHY 224 University Physics III  PHY 225 University Physics III  PHY 226 University Physics III  PHY 227 University Physics III  PHY 228 University Physics III  PHY 229 University Physics III  PHY 229 University Physics III  PHY 210 University Physics III  PHY 220 University Physics III  PHY 221 University Physics III  PHY 222 University Physics III  PHY 223 University Physics III  PHY 226 University Physics III  PHY 218 University Physics III  PHY 229 University Physics III  PHY 220 University Physics III  PHY 221 University Physics III  PHY 222 University Physics III  PHY 223 University Physics III  PHY 224 University Physics III  PHY 225 University Physics III  PHY 226 University Physics III  PHY 227 University Physics III  PHY 228 University Physics III  PHY 229 University Physics III  PHY 229 University Physics III  PHY 220 University Physics III  PHY 221 University Physics III  PHY 222 University Physics III  PHY 223 University Physics III  PHY 224 University Physics III  PHY 225 University Physics III  PHY 226 University Physics III  PHY 227 University Physics III  PHY 228 University Physics III  PHY 229 University Physics III  PHY 220 University Physics III  PHY 220 University Physics III  PHY 221 University Physics III  PHY 222 University Physics III  PHY 225 University Physics III  PHY 226 University Physics III  PHY 227 University Physics III  PHY 228 Universit	MTH 161	Calculus I <sup>4</sup>	4
requirement) Calculus II  Act 204	or MTH 171	Calculus I	
Statistics Requirement   Statistics   Stat	MTH 162	•	4
ASC 204 Environmental Statistics or MTH 224 Introduction to Probability and Statistics or MTH 224 Introduction to Probability and Statistics or MITH 224 Introduction to Probability and Statistics or MITH 224 Or MITH 225 Or SC 120 Computer Programming I P	or MTH 172	Calculus II	
or MTH 224 Introduction to Probability and Statistics    Computational Science Requirement	Statistics Requirement		
Computational Science Requirement ASC 203 Foundations of Computational Marine Science or CSC 120 Computer Programming I  ASC 203 Foundations of Computational Marine Science or CSC 120 Computer Programming I  ASC 203 Foundations of Computational Marine Science  ASC 203 Foundations of Computer Programming I  ASC 203 Foundations II  ASC 203 Foundati	MSC 204	Environmental Statistics	3
### ASC 203   Foundations of Computational Marine Science   44 or CSC 120   Computer Programming I   #### ASC 120   Computer Programming I   ###################################	or MTH 224	Introduction to Probability and Statistics	
ror CSC 120 Computer Programming I Shysics Requirements  Felect one of the following options: First-Year Writing I	Computational Science Requirement		
Physics Requirements  Select one of the following options: 100  PHY 201 University Physics I for the Sciences PHY 106 Physics Laboratory 1 PHY 202 University Physics II for the Sciences PHY 108 Physics Laboratory 2  PHY 108 Physics Laboratory 2  PHY 210 University Physics II for the Sciences PHY 210 University Physics II for the Sciences PHY 210 University Physics II PHY 221 University Physics II PHY 222 University Physics II PHY 223 University Physics III PHY 224 University Physics III Lab Or PHY 225 University Physics II Lab Or PHY 226 University Physics II Lab Or PHY 227 University Physics II Lab Or PHY 228 University Physics III Lab Or PHY 229 University Physics III Lab Or PHY 200 PHY 200 PHY 200 University Physics III Lab Or PHY 200 PHY 200 University Physics III Lab Or PHY 200 PHY 200 University Physics III Lab Or PHY 200 PHY 200 University Physics III Lab Or PHY 200 PHY 200 PHY 200 University Physics III Lab Or PHY 200 PHY 200 University Physics III Lab Or PHY 200 PHY 200 University Physics III Lab Or PHY 200 University Physics III Lab	MSC 203	Foundations of Computational Marine Science	4
Select one of the following options: Option 1 (recommended): PHY 201 University Physics I for the Sciences PHY 106 Physics Laboratory 1 PHY 202 University Physics II for the Sciences PHY 108 Physics Laboratory 2 PHY 201 University Physics II for the Sciences PHY 201 University Physics II For the Sciences PHY 201 University Physics II I PHY 221 University Physics II I PHY 222 University Physics II I I I I I I I I I I I I I I I I I	or CSC 120	Computer Programming I	
PHY 201 University Physics I for the Sciences PHY 106 Physics Laboratory 1 PHY 202 University Physics II for the Sciences PHY 108 Physics Laboratory 2 PHY 108 Physics Laboratory 2 PHY 21 University Physics II PHY 221 University Physics II PHY 222 University Physics II PHY 223 University Physics II PHY 224 University Physics II Lab or PHY 255 University Physics III Lab PHY 256 University Physics III Lab PHY 215 University Physics III Lab PHY 216 University Physics III Lab PHY 217 University Physics III Lab PHY 218 University Physics III Lab PHY 219 University Physics III Lab PHY 219 University Physics III Lab PHY 210 University Physics III PHY 210 University Physics II PHY 210 University Physics III	Physics Requirements		
PHY 201 University Physics I for the Sciences PHY 106 Physics Laboratory 1 PHY 202 University Physics II for the Sciences PHY 108 Physics Laboratory 2 Physics Laboratory 2 Physics Laboratory 2 Physics Laboratory 2 PHY 221 University Physics I PHY 222 University Physics II PHY 223 University Physics III PHY 224 University Physics III Lab Or PHY 225 University Physics III Lab Or PHY 25 University Physics III Lab Or PHY 26 University Physics III Lab Or PHY 27 University Physics III Lab Or PHY 27 University Physics III Lab Or PHY 28 University Physics III Lab Or PHY 29 University Physics III Lab Or PHY 29 University Physics III Lab Or PHY 200 University Physics III Or PHY 2	Select one of the following options:		10
PHY 106 Physics Laboratory 1 PHY 202 University Physics II for the Sciences PHY 108 Physics Laboratory 2  PHY 211 University Physics I PHY 221 University Physics II PHY 222 University Physics II PHY 223 University Physics III PHY 224 University Physics III Lab or PHY 225 University Physics III Lab the result of the Science III Lab First-Year Writing I First-Year Writing I First-Year Writing II: STEM or WRS 106 First-Year Writing II: STEM or WRS 106 First-Year Writing III Or ENG 106 Writing About Literature and Culture Cuantitative Skills:  MTH 161 Calculus I (fulfilled through the major) or MTH 171 Calculus I Wreas of Knowledge: Writing and Humanities Cognate People and Society Cognate STEM Cognate (9 credits) (fulfilled through the major)  Or Cognate (9 credits) (fulfilled through the major)  Or Cognate (9 credits) (fulfilled through the major)	Option 1 (recommended):		
PHY 202 University Physics II for the Sciences PHY 108 Physics Laboratory 2  PHY 221 University Physics I PHY 222 University Physics II PHY 223 University Physics II PHY 224 University Physics II Lab or PHY 225 University Physics II Lab or PHY 226 University Physics II Lab every label of the Science Service of the Science Service of the Science II Lab or PHY 227 University Physics II Lab or PHY 228 University Physics II Lab University Physics II Lab University Physics II Lab or PHY 209 University Physics II Lab University Physics II	PHY 201	University Physics I for the Sciences	
PHY 108 Physics Laboratory 2  PHY 221 University Physics I PHY 222 University Physics II PHY 223 University Physics III PHY 224 University Physics III Lab or PHY 225 University Physics III Lab or PHY 226 University Physics III Lab or PHY 227 University Physics III Lab or PHY 228 University Physics III Lab or PHY 229 University Physics III Lab or PHY 229 University Physics III Lab or PHY 220 University Physics II Lab Or PHY 220 University P	PHY 106	Physics Laboratory 1	
PHY 221 University Physics I PHY 222 University Physics II PHY 223 University Physics III PHY 224 University Physics II Lab Or PHY 225 University Physics II Lab Or PHY 226 University Physics II Lab Or PHY 227 University Physics III Lab Or PHY 228 University Physics III Lab Or PHY 229 University Physics III Or PHY 229 University Physic	PHY 202	University Physics II for the Sciences	
PHY 221 University Physics I PHY 222 University Physics II PHY 223 University Physics III PHY 224 University Physics II Lab or PHY 225 University Physics III Lab University Physics II	PHY 108	Physics Laboratory 2	
PHY 222 University Physics II PHY 223 University Physics III PHY 224 University Physics II Lab or PHY 225 University Physics II Lab University Physics II University Physics II University Physics III University Physics III University Physics II University P	Option 2:		
PHY 223 University Physics III PHY 224 University Physics II Lab or PHY 225 University Physics III Lab General Education Requirements Written Communication Skills: WRS 105 First-Year Writing I WRS 107 First-Year Writing II: STEM or WRS 106 First-Year Writing II or ENG 106 Writing About Literature and Culture Quantitative Skills: MTH 161 Calculus I (fulfilled through the major) or MTH 171 Calculus I Wreas of Knowledge: Wrst and Humanities Cognate Greeple and Society Cognate STEM Cognate (9 credits) (fulfilled through the major)	PHY 221	University Physics I	
PHY 224 University Physics II Lab or PHY 225 University Physics III Lab  Viriten Communication Skills:  VRS 105 First-Year Writing I Or WRS 106 First-Year Writing II: STEM Or WRS 106 First-Year Writing II Or ENG 106 Writing About Literature and Culture  Quantitative Skills:  MTH 161 Calculus I (fulfilled through the major) Or MTH 171 Calculus I  Vereas of Knowledge: Vers and Humanities Cognate Vers and Humanities Cognate Vers and Society Cognate Vers and Society Cognate Vers and Society Cognate Stems of Stems o	PHY 222	University Physics II	
or PHY 225 University Physics III Lab  Seneral Education Requirements  Written Communication Skills:  WRS 105 First-Year Writing I  WRS 107 First-Year Writing II: STEM  or WRS 106 First-Year Writing II  or ENG 106 Writing About Literature and Culture  Quantitative Skills:  MTH 161 Calculus I (fulfilled through the major)  or MTH 171 Calculus I  wreas of Knowledge:  wrts and Humanities Cognate  STEM Cognate (9 credits) (fulfilled through the major)	PHY 223	University Physics III	
Seneral Education Requirements  Written Communication Skills:  VRS 105 First-Year Writing I  VRS 107 First-Year Writing II: STEM  or WRS 106 First-Year Writing II  or ENG 106 Writing About Literature and Culture  Quantitative Skills:  MTH 161 Calculus I (fulfilled through the major)  or MTH 171 Calculus I  Areas of Knowledge:  Arts and Humanities Cognate  People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	PHY 224	University Physics II Lab	
VRS 105 First-Year Writing I 3 VRS 107 First-Year Writing II: STEM 3 or WRS 106 First-Year Writing III or ENG 106 Writing About Literature and Culture Quantitative Skills:  MTH 161 Calculus I (fulfilled through the major) or MTH 171 Calculus I Areas of Knowledge: Arts and Humanities Cognate People and Society Cognate People and Society Cognate STEM Cognate (9 credits) (fulfilled through the major)	or PHY 225	University Physics III Lab	
VRS 105 First-Year Writing I STEM  or WRS 106 First-Year Writing II  or ENG 106 Writing About Literature and Culture  Quantitative Skills:  MTH 161 Calculus I (fulfilled through the major)  or MTH 171 Calculus I  Areas of Knowledge:  Arts and Humanities Cognate  People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	General Education Requirements		
VRS 107 First-Year Writing II: STEM  or WRS 106 First-Year Writing II  or ENG 106 Writing About Literature and Culture  Quantitative Skills:  MTH 161 Calculus I (fulfilled through the major)  or MTH 171 Calculus I  Areas of Knowledge:  Arts and Humanities Cognate  People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	Written Communication Skills:		
or WRS 106 First-Year Writing II or ENG 106 Writing About Literature and Culture  Quantitative Skills:  MTH 161 Calculus I (fulfilled through the major) or MTH 171 Calculus I  Areas of Knowledge: Arts and Humanities Cognate People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	WRS 105	First-Year Writing I	3
or ENG 106 Writing About Literature and Culture Quantitative Skills:  MTH 161 Calculus I (fulfilled through the major)  or MTH 171 Calculus I Areas of Knowledge: Arts and Humanities Cognate People and Society Cognate STEM Cognate (9 credits) (fulfilled through the major)	WRS 107	First-Year Writing II: STEM	3
Auantitative Skills:  MTH 161 Calculus I (fulfilled through the major) or MTH 171 Calculus I  Areas of Knowledge: Arts and Humanities Cognate People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	or WRS 106	First-Year Writing II	
MTH 161 Calculus I (fulfilled through the major) or MTH 171 Calculus I  Areas of Knowledge: Arts and Humanities Cognate People and Society Cognate STEM Cognate (9 credits) (fulfilled through the major)	or ENG 106	Writing About Literature and Culture	
or MTH 171 Calculus I  Areas of Knowledge: Arts and Humanities Cognate  People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	Quantitative Skills:		
Areas of Knowledge: Arts and Humanities Cognate People and Society Cognate STEM Cognate (9 credits) (fulfilled through the major)	MTH 161	Calculus I (fulfilled through the major)	
Arts and Humanities Cognate People and Society Cognate STEM Cognate (9 credits) (fulfilled through the major)	or MTH 171	Calculus I	
People and Society Cognate STEM Cognate (9 credits) (fulfilled through the major)	Areas of Knowledge:		
STEM Cognate (9 credits) (fulfilled through the major)	Arts and Humanities Cognate		9
	People and Society Cognate		9
Total Credit Hours 122-123	STEM Cognate (9 credits) (fulfilled through the major)		
	Total Credit Hours		122-123

MSC 351 and MSC 352 taken together in the Galapagos may be used to complete the MSC 301 requirement and 3 credits of approved Rosenstiel School electives

At least 6 of which must be at the 300-level or higher. MSC 204 and MSC 425 do not satisfy the Rosenstiel School elective requirement. ATM courses, GSC courses, and courses from other Schools are allowed only if taken from an approved list (https://undergraduate.rsmas.miami.edu/academics/majors/marine-science-dual-major-programs/).

An upper-level Rosenstiel School course with Chemistry topics, including MSC 317, MSC 402, MSC 417, MSC 419, OCE 512, and OCE 522.

Calculus I must be passed with a grade of "C-" or higher.

Students who participate in the UGalapagos Program may use MSC 424 (a 3-credit course) to fulfill the Geological Sciences requirement and complete the BSMAS degree in 122 credits. All other students will need to complete 123 credits.

## **Suggested Plan of Study**

This is only a sample. There are numerous ways students can create plans of study for the Marine Science/Chemistry major. Students should feel empowered to use the information listed in the Academic Bulletin to take charge of their education, pursue their own academic interests, and create their own, unique plans of study.

Freshman Year		
Fall		Credit Hours
MSC 111	Introduction to Marine Science	3
MSC 112	Introduction to Marine Science Lab	1
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
WRS 105	First-Year Writing I	3
MTH 161	Calculus I	4
	Credit Hours	16
Spring		
MSC 215	Chemical Oceanography	3
MSC 216	Chemical Oceanography Laboratory	1
GSC 111	Earth System History	4
WRS 107	First-Year Writing II: STEM	3
MTH 162	Calculus II	4
	Credit Hours	15
Sophomore Year		
Fall		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
CHM 221	Introduction to Structure and Dynamics	4
CHM 205	Chemical Dynamics Laboratory	1
PHY 201	University Physics I for the Sciences	4
PHY 106	Physics Laboratory 1	1
	Credit Hours	15
Spring		
MSC 301	Introduction to Physical Oceanography	3
CHM 222	Organic Reactions and Synthesis	4
CHM 206	Organic Reactions and Synthesis Laboratory	2
PHY 202	University Physics II for the Sciences	4
PHY 108	Physics Laboratory 2	1
MSC 204	Environmental Statistics	3
	Credit Hours	17
Junior Year		
Fall		
MSC 203	Foundations of Computational Marine Science	4
MBE 230	Introduction to Marine Biology	3
MBE 232	Introduction to Marine Biology Laboratory	1
CHM 214	Quantitative Analytical Chemistry	3
CHM 360	Physical Chemistry I (Lecture)	3
CHM 364	Physical Chemistry (Laboratory I)	1
	Credit Hours	15
Spring	The Observation of Freedom I Tree	_
CHM 317	The Chemistry of Food and Taste.	3
CHM 320	Instrumental Methods in Chemistry and Biochemistry	2
CHM 365	Physical Chemistry II (Lecture)	3
A&H Cognate Course #1		3

A&H Cognate Course #2		3
	Credit Hours	14
Senior Year		
Fall		
CHM 401	Environmental Chemistry	3
BMB 401	Biochemistry for the Biomedical Sciences	4
MSC Course		3
A&H Cognate Course #3		3
P&S Cognate Course #1		3
	Credit Hours	16
Spring		
CHM 441	Inorganic Chemistry (Lecture)	3
MSC Course		3
CHM/MSC Elective		3
P&S Cognate Course #2		3
P&S Cognate Course #3		3
	Credit Hours	15
	Total Credit Hours	123

Students must take one laboratory from MBE 232 or MSC 302.

#### **Mission**

The mission of the Rosenstiel School of Marine, Atmospheric, and Earth Science is to deepen our collective knowledge of our planet through cuttingedge scientific research on the oceans, atmosphere, geology, biota, and the human dimension, while training the next generation of scientists. We transfer the knowledge gained to our students, the national and international scientific community, and to policymakers and the public.

The educational mission of the BS degree in Marine Science at the University of Miami is to graduate students with the ability and desire to integrate knowledge of marine science into their future careers.

#### **Goals**

Students completing this double major will be able to master a broad set of fundamental scientific knowledge in Marine Science and Chemistry, acquire valuable technical skills and learn how to apply this knowledge to real-world problems, in light of increasing societal issues facing humanity today. The program will provide the rigor, flexibility, depth and integration to enable students to:

- · Design and pursue their course of study that meets requirements of a double major in Marine Science and Chemistry.
- · Learn from the diverse and outstanding group of professors and researchers who are experts in their fields and have active research programs.
- Undertake active research experiences, which will allow them to gain a strong understanding of the scientific process and provide them with a set
  of valuable experimental and computational skills.
- · Prepare themselves for graduate school and for successful careers in public and private industries.

### **Student Learning Outcomes**

- · Students will demonstrate an ability to communicate effectively.
- Students will develop analytical and quantitative skills to allow critical data analysis.
- Students will be able to do carry out supervised research in the field of marine science.
- Students will be able to present and synthesize background information from scientific literature and report findings from their laboratory
  experiments or observations from their field work.