

## College of Natural, Applied and Health Sciences

The mission of the College of Natural, Applied and Health Sciences is consistent with the overall mission of the University. The College of NAHS has strong, quality program offerings in the sciences and health professions. The faculty and staff are committed to providing relevant education and services to a diverse student population. The goal is to prepare students to think critically and creatively so that they can adapt to changing social, economic and technological conditions. Building external collaborations with major technological corporations and the health care industry is an integral part of the colleges outreach mission, which enables it to provide valuable services to the community as well as increased opportunities for students.

We are proud to have been designated the Flagship State University for the Health Professions. Our graduates can be found practicing in hospitals and other health care agencies across New Jersey. Also, our programs in the Sciences have a long distinguished record of service to this region. So, whether you are looking to study in the Natural and Physical Sciences, Health Care, Mathematics, Technology, or Computer Science, you will gain a strong foundation at the College of Natural, Applied and Health Sciences.

*Interim Dean, Pablo Zafra*

*Assistant to the Dean, Lourdes F. Prieto*

*B-104, (908) 737-3600*

### ACADEMIC DEGREES, PROGRAMS

#### B.A. in Biology

- General Option
- Honors Option
- Teacher Certification Option
- Teacher of Students with Disabilities Option

#### B.S. in Biology

- General Option
- Biotechnology Option

#### B.A. in Chemistry

- General Option
- Preprofessional Option
- Teacher Certification Option

#### B.S. in Chemistry, Expanded Option

#### B.S. in Computer Science

- Information Systems Option

#### B.A. in Earth Science

- General Option
- Teacher Certification Option
- Teacher of Students with Disabilities Option

#### B. S. in Earth Science

- Earth System Science Option
- Geology Option
- Meteorology Option

#### B.A. in Mathematical Sciences

- Teacher Certification Option
- Teacher of Students with Disabilities Option

#### B.S. in Computer Integrated Design and Manufacturing Technology

#### B.S. in Electronics Technology

#### B.S. in Telecommunications and Information Technology

### HEALTH PROFESSIONS

#### B.S. in Health Information Management

- General Option
- Occupational Therapy Track

#### B.S. in Medical Technology

- General Option
- Cytotechnology Option
- Histotechnology Option

#### B.S.N. in Nursing

#### Post Baccalaureate School Nurse Program

### JOINT (OR COMBINED) DUAL DEGREE PROGRAMS

#### B.S. in Health Information Management/ M.S. Management Information Systems

#### B.S. in Health Information Management/ M.A. Communication Studies

#### B.A. / M.S. in Occupational Therapy

#### B.A. / DPT Physical Therapy (with UMDNJ)

### COLLABORATIVE PROGRAM

BA in Elementary Education Liberal Studies in Mathematics, Science, and Technology:

- Biology Specialization
- Earth Science Specialization
- Mathematics Specialization
- Technology Specialization

### DEPARTMENTS, FACULTY

#### Biological Sciences

Faculty: Codella, Field, Glazer, Hayat, James, Mancarella (Chairperson), Osborne, Porta, Pu, Rosenthal, Vassiliou, Yu, Zhang

#### Chemistry-Physics

Faculty: Castiglione, Criasia (Chairperson), Gao, Getzin, Hicks, Kampa, Kubow, Lees, Shin, Stokes-Huby, Vitale, Zarrilli

#### Geology and Meteorology

Faculty: Croft, Dobosiewicz, Krall, Kroll, Manfrino, Metz (Chairperson), Murphy, Ngoy, Yoh, Zois

#### Mathematics and Computer Science

Faculty: Abeles, Affouf, Alsina, Arnow, Avirappattu, Beaugris, Chang, Deavours, Emanouilidis, Hahn (Chairperson), Halper, Krantz, Lehmann, Lipson, Mathur, Narasimhan, Ryder, Santomauro, Stewart-Gardiner, Tse, Viglione, Wang, Wittenberg, Woubneh, Zafra

#### Technology

Faculty: Behi, Cokewood, Shahrabi (Chairperson)

#### Health Information Management

Faculty: Davis, Manger (Chairperson)

#### Medical Technology

Coordinator: Osborne

#### Nursing

Faculty: Campbell (Chairperson), Fitzgerald, Fitzsimons, Hascup, Krause-Parello, Neville, Pisani

#### Occupational Therapy

Faculty: Knis-Matthews, Richard, Stern (Chairperson)

# Earth Science

Chairperson: Dr. Robert Metz  
C-323A, (908) 737-3690

The programs in the earth sciences are designed to prepare the student for careers and/or graduate study in various areas of geology, meteorology, oceanography, and environmental science. In addition programs for teacher certification in earth science and elementary education with an earth science specialization are offered. Collateral studies in environmental and marine sciences may be elected with the Earth Science major.

## B.S. DEGREE EARTH SCIENCE

### OPTION: GEOLOGY

The geology program is designed for students who plan to become professional geologists. The curriculum meets the requirements of the American Institute of Professional Geologists and prepares students for careers in geology and/or graduate study.

### GENERAL EDUCATION 52-53

### FOUNDATIONS REQUIREMENTS 13

GE 1000	Transition to Kean	1
ENG 1030	College Composition	3
MATH 1000	Algebra for College Students #	3
COMM 1402	Speech Communication as Critical Citizenship	3
GE 2024	Research and Technology	3

### DISCIPLINARY/INTERDISCIPLINARY

### DISTRIBUTION REQUIREMENTS

<i>Humanities</i>		9
*ENG 2403	World Literature	
Select two courses from different areas:		
Fine Arts or Art History		3
Foreign Languages		3
Music or Theatre		3
Philosophy or Religion		3
Interdisciplinary		3
<i>Social Sciences</i>		9
*HIST 1000	History of Civil Society in America	3
Select two courses from different areas:		
Economics or Geography		3
Political Science		3
Psychology		3
Sociology or Anthropology		3
Interdisciplinary		3
<i>Science &amp; Mathematics</i>		11
*MATH 1054	Precalculus ##	3
CHEM 1083	Chemistry I	4
CHEM 1084	Chemistry II	4

<i>Health/Physical Education</i>		2-3
ID 1225	Issues Contemporary Health	3

### OR

Physical Education		2
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### CONCENTRATION 8

PHYS 2091	General Physics I	4
PHYS 2092	General Physics II	4

\* Required Distribution Course

### ADDITIONAL REQUIREMENTS 11

MATH 2411	Calculus I	3
BIO 1000	Principles of Biology	4
CPS 1231	Fundamentals of Computer Science	4

### MAJOR AND CAPSTONE REQUIREMENTS 56

GEOL 1200	Introduction to Geology	4
ES 2200	Methods in Geoscience	4
ES 3200	GIS in Geoscience	4
GEOL 3261	Mineralogy	4
GEOL 3263	Structural Geology	4
GEOL 3264	Invertebrate Paleontology	4
GEOL 3265	Geomorphology	4
GEOL 3281	Field Geology I	2
GEOL 4252	Field Geology II	2
GEOL 4265	Petrology	4
GEOL 4266	Stratigraphy and Sedimentation	4

*Major/GE Capstone Course*

ES 4953-4954	ES Seminar I and II	
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### OR

ES 4963-4964	Honors Research Seminar in ES I and II	2,2
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### Major Electives 12

Courses selected with departmental advisement.

### FREE ELECTIVES 4 -5

(50% of free electives must be at the 3000-4000 level)

### TOTAL 124

# Students eligible to take MATH 1054  
*Precalculus based on their placement test may take that course in place of MATH 1000 and take an additional three credits in Free Electives to total 124 S.H.*

## Students eligible to take MATH 2411 Calculus I based on their placement test may take that course in place of MATH 1054. In that case, MATH 2411 will fulfill the Distribution requirement and the student may take an additional three credits in Free Electives to total 124 S.H.

## B.S. DEGREE EARTH SCIENCE

### OPTION: METEOROLOGY

The meteorology program is designed for students who plan to pursue careers in meteorology and the atmospheric sciences. The curriculum meets the requirements of the National Weather Service and prepares students for both employment and graduate study.

### GENERAL EDUCATION 50-51

### FOUNDATIONS REQUIREMENTS 13

GE 1000	Transition to Kean University	1
ENG 1030	College Composition	3
MATH 1000	Algebra for College Students #	3
COMM 1402	Speech Communication as Critical Citizenship	3
GE 2024	Research and Technology	3

### DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS

<i>Humanities</i>		9
*ENG 2403	World Literature	3
Select two courses from different areas:		
Fine Arts or Art History		3
Foreign Languages		3
Music or Theatre		3
Philosophy or Religion		3
Interdisciplinary		3

### *Social Sciences* 9

*HIST 1000	History of Civil Society in America	3
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Select two courses from different areas:

Economics or Geography		3
Political Science		3
Psychology		3
Sociology or Anthropology		3
Interdisciplinary		3

### *Science & Mathematics* 11

*MATH 1054	Precalculus ##	3
PHYS 2095	Physics I	4
PHYS 2096	Physics II	4

### *Health/Physical Education* 2-3

ID 1225	Issues Contemporary Health	3
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### OR

Physical Education		2
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\* Required Distribution Course

### CONCENTRATION

MATH 2411	Calculus I	3
MATH 2412	Calculus II	3

<b>ADDITIONAL REQUIREMENTS</b>	<b>11</b>
CPS 2231 Computer Organization and Programming	4
MATH 3455 Differential Equations	3
GEOL 3266 Hydrology	4

**MAJOR AND CAPSTONE REQUIREMENTS 53**

METR 1300 Introduction to Meteorology	4
ES 2200 Methods in Geoscience	4
METR 3370 Atmospheric Dynamics	4
METR 3371 Atmospheric Thermodynamics	4
METR 3372 Physical Meteorology	3
METR 3380 Meteorological Instrumentation	4
METR 4351 Synoptic Meteorology I	4
METR 4352 Synoptic Meteorology II	4
METR 4370 Advanced Atmospheric Dynamics	3
ES 4200 Remote Sensing	4

*Major/GE Capstone Course*

ES 4953-4954 ES Seminar I & II	
<b>OR</b>	
ES 4963-4964 Honors Research Seminar in ES I & II	2, 2

*Major Electives* 11  
(50% at the 3000-4000 level)

Courses selected with departmental advisement.

<b>FREE ELECTIVES</b>	<b>9-10</b>
(50% of free electives must be at the 3000-4000 level)	

<b>TOTAL</b>	<b>124</b>
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*# Students eligible to take MATH 1054 Precalculus based on their placement test may take that course in place of MATH 1000 and take an additional three credits in Free Electives to total 124 S.H.*

*## Students eligible to take MATH 2411 Calculus I based on their placement test may take that course in place of MATH 1054. In that case, MATH 2411 will fulfill the Distribution requirement and the student may take an additional three credits in Free Electives to total 124 S.H.*

**B.S. DEGREE EARTH SCIENCE**

**OPTION: EARTH SYSTEM SCIENCE**

The Earth System Science program prepares our students for the demands and challenges of interdisciplinary careers and/or graduate studies in the geosciences. The option will emphasize using modern quantitative and analytical skills for exploring multi-disciplinary problems in a collaborative environment.

<b>GENERAL EDUCATION</b>	<b>50-51</b>
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<b>FOUNDATIONS REQUIREMENTS</b>	<b>13</b>
GE 1000 Transition to Kean	1
ENG 1030 College Composition	3
MATH 1000 Algebra for College Students #	3
COMM 1402 Speech Communications as Critical Citizenship	3
GE 2024 Research and Technology	3

**DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS**

<i>Humanities</i>	9
*ENG 2403 World Literature	3
Select two courses from different areas:	
Fine Arts or Art History	3
Foreign Languages	3
Music or Theatre	3
Philosophy or Religion	3
Interdisciplinary	3
<i>Social Sciences</i>	9
*HIST 1000 History of Civil Society in America	3

Select two courses from different areas:

Economics or Geography	3
Political Science	3
Psychology	3
Sociology or Anthropology	3
Interdisciplinary	3

<i>Science &amp; Mathematics</i>	11
*MATH 1054 Precalculus ##	3
CHEM 1083 Chemistry I	4
CHEM 1084 Chemistry II	4
<i>Health/Physical Education</i>	2-3
ID 1225 Issues Contemporary Health	3

<b>OR</b>	
ID 1010 Leisure & Rec Multicult Soc	3
<b>OR</b>	
Physical Education	1
Physical Education	1

**CONCENTRATION**

MATH 2411 Calculus I	3
MATH 2412 Calculus II	3

<b>ADDITIONAL REQUIREMENTS</b>	<b>13</b>
BIO 1000 Principles of Biology	4
MATH 2526 Applied Statistics	3
COMM2405 Public Speaking	3
ENG 3090 Prof. & Tech. Writing	3

**MAJOR AND CAPSTONE REQUIREMENTS 49-51**

<b>REQUIRED COURSES</b>	<b>37</b>
ES 1000 Observing the Earth	3
ES 2000 Foundations of ESS	4
ES 2200 Methods in Geoscience	4
ES 3200 GIS in Geoscience	4

ES 3310 Geosphere	4
ES 3320 Atmosphere	4
ES 3330 Hydrosphere/Ocean	4
ES 4200 Remote Sensing	4
ES 4980 Env. Issues Internship	3

*Major/GE Capstone Course*  
\*\*ES 4981 Env. Issues Seminar 3

**INTERDISCIPLINARY ELECTIVES 6**

(Select from Departmental approved interdisciplinary courses in Geography, Biology, Chemistry, Public Administration, or Economics)

**MAJOR ELECTIVES 6-8**

(Select from Departmental approved 3000-4000 level courses in Geology, Meteorology, and Oceanography)

**FREE ELECTIVES 9-12**

**B.A. DEGREE EARTH SCIENCE**

**OPTION: GENERAL**

The general earth science program provides students with a broad background in the earth sciences. This option covers the spectrum of earth science with emphasis on problem solving and topics of environmental importance.

**GENERAL EDUCATION 50-53**

<b>FOUNDATIONS REQUIREMENTS</b>	<b>13</b>
GE 1000 Transition to Kean	1
ENG 1030 College Composition	3
MATH 1000 Algebra for College Students #	3
COMM 1402 Speech Communications as Critical Citizenship	3
GE 2024 Research and Technology	3

**DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS**

<i>Humanities</i>	9
*ENG 2403 World Literature	3
Select two courses from different areas:	
Fine Arts or Art History	3
Foreign Languages	3
Music or Theatre	3
Philosophy or Religion	3
Interdisciplinary	3
<i>Social Sciences</i>	9
*HIST 1000 History of Civil Society in America	3

Select two courses from different areas:

Economics or Geography	3
Political Science	3
Psychology	3
Sociology or Anthropology	3
Interdisciplinary	3

Science & Mathematics	11
*MATH 1054 Precalculus ##	3
<b>AND</b>	
CHEM 1083 Chemistry I	4
CHEM 1084 Chemistry II	4
<b>OR</b>	
PHYS 2091 General Physics I	4
PHYS 2092 General Physics II	4
Health/Physical Education	2-3
ID 1225 Issues of Contemporary Health	3
<b>OR</b>	
Physical Education	2
* Required Distribution Course	
<b>CONCENTRATION</b>	<b>6-8</b>
A Concentration is a two-course sequence in the Liberal Arts and Sciences, outside the major, that builds upon an introductory GE Distribution course.	
<b>ADDITIONAL REQUIREMENTS</b>	<b>3</b>
MATH 2411 Calculus I	3
<b>OR</b>	
MATH 2412 Calculus II	3
<b>MAJOR AND CAPSTONE REQUIREMENTS</b>	<b>31</b>
ASTR 1100 Introduction to Astronomy	4
GEOL 1200 Introduction to Geology	4
METR 1300 Introduction to Meteorology	4
METR 2300 Climatology	3
GEOL 3266 Hydrology	4
OCEN 3453 Introduction to Oceanography	4
One of the following courses	4
GEOL 3261, GEOL 3263, GEOL 3264, GEOL 3265	
<i>Major/GE Capstone Course</i>	
ES 4953-4954 ES Seminar I & II	
<b>OR</b>	
ES 4963-4964 Honors Research Seminar in ES I & II	2, 2
<b>FREE ELECTIVES</b>	<b>37-40</b>
(50% of free electives must be at the 3000-4000 level.)	
<b>TOTAL</b>	<b>124</b>
# Students eligible to take MATH 1054 Precalculus based on their placement test may take that course in place of MATH 1000 and take an additional three credits in Free Electives to total 124 S.H.	
## Students eligible to take MATH 2411 Calculus I based on their placement test may take that course in place of MATH 1054. In that case, MATH 2411 will fulfill the Distribution requirement and the student may take an additional three credits in Free Electives to total 124 S.H.	

<b>B.A. DEGREE EARTH SCIENCE</b>	
<b>OPTION: TEACHER CERTIFICATION</b>	
Students choosing this (K-12) option must make a formal application for admission to the Elementary, Middle and Secondary Education (EMSE) Department. Prior to taking education courses, all prerequisites must be met. See the description under the College of Education.	
<b>GENERAL EDUCATION AND ADDITIONAL</b>	
<b>LIBERAL ARTS REQUIREMENTS</b>	<b>66</b>
<b>GENERAL EDUCATION REQUIREMENTS</b>	<b>45</b>
<b>FOUNDATIONS REQUIREMENTS</b>	<b>13</b>
GE 1000 Transition to Kean	1
ENG 1030 College Composition	3
MATH 1000 Algebra for College Students #	3
COMM 1402 Speech Communication as Critical Citizenship	3
GE 2024 Research and Technology	3
<b>DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS</b>	
<i>Humanities</i>	9
*ENG 2403 World Literature	3
Select two courses from different areas:	
Fine Arts or Art History	3
Foreign Languages	3
Music or Theatre	3
Philosophy or Religion	3
Interdisciplinary	3
<i>Social Sciences</i>	9
*HIST 1000 History of Civil Society in America	3
PSY 1000 General Psychology	3
SOC 1000 Intro to Sociology	3
<b>OR</b>	
ANTH 1800 Cultural Anthropology	3
<i>Science &amp; Mathematics</i>	11
*MATH 1054 Precalculus ##	3
CHEM 1083 Chemistry I	4
BIO 1000 Principles of Biology	4
Health/Physical Education	3
ID 1225 Issues of Contemporary Health	3
* Required Distribution Course	
<b>ADDITIONAL REQUIREMENTS</b>	<b>21</b>
MATH 2411 Calculus I	3
<b>OR</b>	
MATH 2412 Calculus II	3
CHEM 1084 Chemistry II	4
PHYS 2091 Physics I	4
PHYS 2092 Physics II	4
PSY 2110 Psychology of Adolescence	3
One additional DIS or ID course	3

<b>MAJOR AND CAPSTONE REQUIREMENTS</b>	<b>31</b>
ASTR 1100 Introduction to Astronomy	4
GEOL 1200 Introduction to Geology	4
METR 1300 Introduction to Meteorology	4
METR 2300 Climatology	3
GEOL 3266 Hydrology	4
OCEN 3453 Introduction to Oceanography	4
One of the following courses:	4
GEOL 3261, GEOL 3263, GEOL 3264, GEOL 3265	
<i>Major/GE Capstone Course</i>	
ES 4953-4954 ES Seminar I & II	2, 2
<b>OR</b>	
ES 4963-4964 Honors Research Seminar in ES I & II	2, 2
<b>PROFESSIONAL EDUCATION</b>	<b>30</b>
<i>Sophomore Level</i>	
EMSE 2801 Introductory Field Experience K-12	3
<i>Junior Level</i>	
EDUC 3000 Curriculum, Evaluation and the Learner	3
EDUC 3401 Language Arts/Reading K-12	3
EMSE 3122 Computers in Education	3
EMSE 3230 Science Education K-12	3
EMSE 3801 Field Experience/Subject Area K-12	2
EMSE 3903 Eng Lang Learn in America	1
<i>Senior Level</i>	
EMSE 4801 Professional Internship/Subject Area K-12	9
<b>PROFESSIONAL/GE CAPSTONE COURSE</b>	
EDUC 4000 Teacher and Classroom	3
<b>TOTAL</b>	<b>127</b>
# Students eligible to take MATH 1054 Precalculus based on their placement test may take that course in place of MATH 1000 and take an additional three credits as Free Electives to total 127 S.H. Students in teacher preparation programs must take the three credits in a liberal arts discipline.	
## Students eligible to take MATH 2411 Calculus I based on their placement test may take that course in place of MATH 1054. In that case, MATH 2411 will fulfill the Distribution requirement and the student may take an additional three credits as Free Electives to total 127 S.H.. Students in teacher preparation programs must take the three credits in a liberal arts discipline.	

## B.A. EARTH SCIENCE / TEACHER OF STUDENTS WITH DISABILITIES (78298)

Students who wish to be certified in both Earth Science K-12 and Educator of Students with Disabilities should consult the Catalogue under Special Education programs for a complete description of this dual certification program.

## B.A. DEGREE IN ELEMENTARY EDUCATION

### OPTION: LIBERAL STUDIES IN MATHEMATICS, SCIENCE, AND TECHNOLOGY

### EARTH SCIENCE SPECIALIZATION K-5 AND 5-8

This is a joint program with the College of Education designed to provide elementary education students the opportunity to pursue a specialization in science, mathematics, or technology. Students choosing this option must make a formal application for admission to the Elementary, Middle and Secondary Education Department. Prior to taking education courses, all prerequisites must be met. Please refer to the Elementary Education program under the College of Education for requirements.

### GENERAL EDUCATION AND ADDITIONAL

#### LIBERAL ARTS REQUIREMENTS 64

#### GENERAL EDUCATION REQUIREMENTS 46

#### FOUNDATIONS REQUIREMENTS 13

GE	1000	Transition to Kean	
ENG	1030	College Composition	3
MATH	1000	Algebra for College Students #	3
COMM	1402	Speech Communication as Critical Citizenship	3
GE	2024	Research and Technology	3

#### DISCIPLINARY/INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS

<i>Humanities</i>		9	
*ENG	2403	World Literature	3
AH	1700	Art History	3
MUS	1050	Music Fundamentals (Rec.)	3
<i>Social Sciences</i>		9	
*HIST	1000	History of Civil Society in America	3
PSY	1000	General Psychology	3
GEOG	2010	World Geography	3
<i>Science &amp; Mathematics</i>		11	
*MATH	1010	Foundations of Mathematics	3
BIO	1000	Principles of Biology	4

Select one course:

PHYS	2091	General Physics I	4
CHEM	1010	Preparatory Chemistry	4
<i>Health and Physical Education</i>		4	
ID	1225	Issues of Contemporary Health	3
PED	1101 or 1103 or 1105		1
<b>ADDITIONAL REQUIREMENTS</b>		<b>15</b>	
PSY	2100	Child Psychology	3
PSY	2110	Psychology of Adolescence	3
HIST	2303	U.S. History to 1877	3
HIST	2304	U.S. History 1877 to Present	3
ID	2950	The Child & Technology	3
ID	2955	Disabled Person in Am. Soc.	3

#### ACADEMIC MAJOR 42-43

#### MATH/SCIENCE/TECHNOLOGY BASIC REQUIREMENTS 23

<i>Mathematics</i>		6	
Select two of the following:			
MATH	1016	Statistics	3
MATH	1030	Problem Solving in Mathematics	3
MATH	1054	Precalculus	3
MATH	2411	Calculus I	3
<i>Biology</i>		4	
BIO	2200	Cell Biology or Biology Elective	4
<i>Earth Science</i>		3-4	
Intro course in Astronomy			
<b>OR</b>			
ES	1000	Observing the Earth	3-4
<i>Technology</i>		9	
CPS	1031	Introduction to Computers	3
CPS	1032	Microcomputer Applications	3
<b>OR</b>			
TECH	2920	Computers in Technology	3
TECH	1100	Technology Systems	3

#### EARTH SCIENCE SPECIALIZATION 20

#### EARTH SCIENCE CORE 12

GEOL	1200	Introduction to Geology	4
METR	1300	Introduction to Meteorology	4
OCEN	3453	Oceanography	4

#### EARTH SCIENCE ELECTIVES 8

8 Credits at the 2000 or higher level, with advisement.

#### PROFESSIONAL EDUCATION 30

EMSE	2802	Expl. Tchg/Lab	3
EDUC	3000	Curriculum, Evaluation and the Learner	3
EDUC	3400	Language Arts/Reading in the Pre-School & Elementary Curriculum	3

EMSE	3123	Mathematics & Science Education	3
EMSE	3140	Social Studies & Contemporary Issues in Education	3
EMSE	3802	Field Experience Elem School	2
EMSE	3300	Middle School Curric. & Phil	3
EMSE	3903	Teaching ELL	1
EMSE	4800	Professional Internship Elem Teaching and Curriculum	9
EMSE	4900	Senior Seminar (Capstone)	3

#### TOTAL 133

# Students eligible for MATH 1054 based on their placement test may take that course in place of MATH 1000 and take an additional three credits as Free Electives to total 133 S.H. Students in teacher preparation programs must take the three credits in a liberal arts discipline.

## ASTRONOMY COURSES

### ASTR 1100 Introduction to Astronomy (4)

A study of our solar system and the sidereal universe, with an emphasis on the nature of astronomical investigation. (3 hr. lec/3 hr. lab.)

Approved General Education Distribution Course

### ASTR 3168 Practical Astronomy (3)

Methods of determining, describing and using the positions and apparent motions of celestial bodies. Topics include fundamental position determination, time systems and standards, celestial navigation, the calendar, and related astronomical instrumentation.

Prerequisites: ASTR 1100 and MATH 2412 or permission of the instructor.

### ASTR 3171 The Solar System (3)

Planets, moons, and other members of the solar system; techniques and results of planetary investigations; theories of planetary origin, efforts to detect other planetary systems, the search for extraterrestrial life.

Prerequisite: ASTR 1100 or permission of instructor.

## EARTH SCIENCE COURSES

### ES 1000 Observing the Earth (3)

A study of the earth and its processes from the perspective of observations and measurement, observing technology and systems, applications of observations and data to problem solving.

Approved General Education Distribution Course

### ES 2000 Foundations of Earth System Science (4)

An introduction to the study of Earth as an inclusive system. The atmosphere, geosphere, biosphere, hydrosphere and cryosphere and their interrelations. (3hr. lec./3 hr. lab.)

Prerequisites: ES 1000 or permission of instructor

**ES 2200 Methods in Geoscience (4)**  
Fundamental skills and scientific techniques used in the study of geoscience: computer applications; Internet resources, spatial data representation and analysis; quantitative descriptions of geophysical phenomena; statistical methods for data analysis; basic numerical methods. (3 hr lec./3 hr lab.)  
*Prerequisites: MATH 1054 and four hours of Geoscience*

**ES 3200 Geographic Information Systems in Geoscience (4)**  
Principles and applications of Geographic Information Systems (GIS). Fundamentals of digital cartography, spatial analysis, digital data. Acquiring, assembling, geo-referencing field data; topographic maps; images from remote sensing. Emphasis on Earth and Human Systems; population, urban development and land use. (3 hr lec./3 hr lab.)  
*Prerequisites: MATH 1054, four hours of Geoscience or permission of instructor*

**ES 3310 The Geosphere in the Earth System (4)**  
Examination of the solid earth as part of an Earth System: Earth origin, chemistry, internal structure and processes, mineralogic and lithologic composition, origin and effect of organisms, history, modern processes and human impacts. (3 hr lec./3 hr lab.)  
*Prerequisites: ES 2000*

**ES 3320 The Atmosphere in the Earth System (4)**  
Examination of the atmosphere as part of an Earth System: History of atmosphere, source of energy, pollution, extreme weather events, atmospheric processes and climatic dynamics, and its interaction with organisms and human impacts. (3 hr lec./3 hr lab.)  
*Prerequisites: ES 2000*

**ES 3330 The Hydrosphere in the Earth System (4)**  
Examination of the distribution and movement of water as part of an Earth System: Oceans and seas, ice, surface waters, groundwater, historical and modern processes, the relationship to organisms and human impacts. (3 hr lec./3 hr lab.)  
*Prerequisites: ES 2000*

**ES 4200 Remote Sensing (4)**  
Theory, technology and methods of remote sensing for observing the earth. Application of remote sensing to problems in the earth sciences including resource exploration, weather forecasting, environmental monitoring and land use. (3 hr lec./3 hr lab.)  
*Prerequisites: Eight hours of Geoscience, MATH 1054, PHYS 2091 or PHYS 2095*

**ES 4980 Environmental Internship (3)**  
A work-study opportunity to obtain practical experience with the multidisciplinary nature of environmental problems, relate course material to these problems, and discern decision-making processes associated with their solution.  
*Prerequisites: Permission of the department and the supervising instructor.*

**ES 4981 Environmental Issues Seminar (3)**  
Contemporary environmental topics are explored from a scientific and societal perspective. Students conduct research and present in written and oral form, issues of local, national, and global concern.  
*Prerequisites: ES 4980*

## GEOGRAPHY COURSES

**GEOG 2010 World Geography (3)**  
World geography from the point of view of how physical features, resources, climates, and economic and political systems help to shape human culture. Using geographic tools to explore current themes and problems in various world geographic regions.  
*Approved General Education Distribution Course*

**GEOG 2020 Conservation of Natural Resources (3)**  
A study of relationships among natural resources, technological development, population growth and levels of living as a means of exploring and evaluating the foundations of environmental management and conservation.  
*Prerequisite: Three hours of geography or science or permission of instructor.*

**GEOG 3110 Practical Geographic Skills(3)**  
The practical skills and techniques of the geographer, such as those developed for studies in the field and the library, and for graphic, cartographic, written and oral presentation of geographic information.  
*Prerequisite: Six hours of geography or permission of instructor.*

**GEOG 3410 Urban Geography (3)**  
An examination of urban settlements with special emphasis on the practical application of modern geographic theories to the contemporary urban situation.  
*Prerequisite: Six hours of geography or permission of instructor.*

**GEOG 3420 The Resource Base and the Urban Pattern (3)**  
An investigation of the problems posed by the multiplicity of users for the limited natural resources of urban areas.  
*Prerequisite: Six hours of geography or permission of instructor.*

**GEOG 3920 Geography of Latin America (3)**  
The physical geography and human adaptation in Middle South America.  
*Prerequisite: Six hours of geography or permission of instructor.*

**GEOG 3950 The Geography of New Jersey (3)**  
The various geographic aspects of the State of New Jersey: physical environment, cultural diversity, resource base, and economic pattern. Special emphasis placed on the high degree of urbanization which characterizes New Jersey. Field observations included.

**ECO 3730 Economic Geography (3)**  
(See Economics and Finance Department for course description.)

## GEOLOGY COURSES

**GEOL 1200 Introduction to Geology (4)**  
Processes at work upon and within the earth; earth history; rocks, minerals, and fossils; historical development of geology as a science. (3 hr. lec/ 3 hr. lab.)  
*Approved General Education Distribution Course*

**GEOL 1201 Geologic Hazards (3)**  
An investigation of geologic hazards such as earthquakes, volcanic eruptions, flooding and beach erosion. Consideration given to hazards resulting from normal geologic activity as well as those caused by human interaction with the environment. Intended for non-majors. May be taken without GEOL 1202. Students cannot receive credit for both GEOL 1200 and GEOL 1201/1202.

**GEOL 1202 Geologic Hazards Laboratory (1)**  
*Must be taken concurrently with GEOL 1202.*

**GEOL 1205 Mineral and Fossil Fuel Resources (3)**  
Minerals and fossil fuels, supplies and their use. Past use and future trends in light of depletion, recycling and technological advances. Does not fulfill major requirements.

**GEOL 1210 Geology of the National Parks (3)**  
An in-depth study of the depositional, tectonic and erosional processes that have produced the unique geological regions designated as National Parks by the Congress of the United States. Does not fulfill major requirements.

**GEOL 2262 Geology and the Environment (3)**  
Examination of the problems associated with man's urban pattern of civilization and resultant interactions with the geologic environment.  
*Prerequisite: GEOL 1200 or permission of the instructor.*

**GEOL 2263 Geology and the Environment Lab (1)**  
*Must be taken concurrently with GEOL 2262.*

**GEOL 3261 Mineralogy (4)**  
An introductory study of minerals; their morphology, internal structure, origin, occurrence, and properties. (3 hr. lec./3 hr. lab.)  
*Prerequisites: GEOL 1200 and CHEM 1083-1084, or permission of the instructor.*

**GEOL 3263 Structural Geology (4)**  
A study of the architecture of the rock materials of the earth, including a description of geologic structure in terms of origin, principles and mechanics of crustal deformation. (3 hr. lec./3 hr. lab.)  
*Prerequisite: GEOL 1200 or permission of the instructor.*

**GEOL 3264 Invertebrate Paleontology (4)**  
A study of the classification, relationships, and evolutionary history of fossils. Emphasis is placed on paleoecological relationships. (3 hr. lec./3 hr. lab.)  
*Prerequisite:* GEOL 1200 or permission of the instructor.

**GEOL 3265 Geomorphology (4)**  
Analysis of the various land forms of the Earth's surface in terms of their nature, origin, and evolution. The influence of the different geologic and climatic environments upon the development of land form. Map interpretation. (3 hr. lec./3 hr. lab.)  
*Prerequisite:* GEOL 1200 or permission of the instructor.

**GEOL 3266 Hydrology (4)**  
The distribution and movement of water with emphasis given to surface waters, their relation to the fluvial aspects of geomorphology and to the impact of man on the hydrologic cycle. (3 hr. lec./3 hr. lab.)  
*Prerequisite:* GEOL 1200 or METR 1300 or permission of instructor.

**GEOL 3269 Astrogeology (4)**  
The geologic environments of the moon and the planets examined with emphasis on the nature of the lunar surface. Consideration given to pertinent terrestrial environments and phenomena and to the related aspects of meteoritics. (3 hr. lec./3 hr. lab.)  
*Prerequisite:* ASTR 1100 or GEOL 1200 or permission of instructor.

**GEOL 3281 Field Geology (2)**  
Field practice in the methods of geological mapping including the use of pace, compass, and clinometer surveys, the plane table and alidade, and aerial photographs.  
*Prerequisite:* GEOL 1200 or permission of the instructor.

**GEOL 4252 Field Geology II (2)**  
Field conference and studies of one or more selected areas with written reports and maps. Additional expenses may be incurred.  
*Prerequisites:* GEOL 3261, 3263, 4266 (may be taken concurrently), or permission of the instructor.

**GEOL 4256 Glacial and Pleistocene Geology (3)**  
Analysis of the distribution, movement, and deposits of modern glaciers used to interpret glacial features formed during the Pleistocene glacial epoch. Theories concerning the cause or causes of continental glaciation.  
*Prerequisite:* GEOL 1200 or permission of the instructor.

**GEOL 4263 Optical Mineralogy (4)**  
Mineral identification through the use of the petrographic microscope by immersion and thin-section methods. (3 hr. lec./3 hr. lab.)  
*Prerequisite:* GEOL 3261 or permission of the instructor.

**GEOL 4265 Petrology (4)**  
A study of the petrologic processes at work upon and within the crust of the earth that produce and modify rock bodies. (3 hr. lec./3 hr. lab.)  
*Prerequisite:* GEOL 3261 or permission of the instructor.

**GEOL 4266 Stratigraphy and Sedimentation (4)**  
Origin and characteristics of sediment grains; sedimentation processes; diagenesis and rock classification; correlation of stratigraphic units; sedimentary environments and their deposits. (3 hr. lec./3 hr. lab.)  
*Prerequisite:* Twelve hours of geology or permission of the instructor.

**GEOL 4268 Topographic Map Interpretation (3)**  
Description and interpretation of selected topographic maps chosen to illustrate variety of landforms of the United States and the influence of structure, process and time on landform development. (1 hr. lec./6 hr. lab.)  
*Prerequisite:* GEOL 3265 (may be taken concurrently) or permission of instructor.

## METEOROLOGY COURSES

**METR 1300 Introduction to Meteorology (4)**  
An introductory study of the atmosphere including historical perspectives, weather elements, instrumentation, fronts, air masses, cyclones and anticyclones, severe weather, weather analysis, weather prediction, pollution, ozone layer depletion, acid rain, global warming. (3 hr. lec./3 hr. lab.)  
*Approved General Education Distribution Course*

**METR 2300 Climatology (3)**  
Global distribution of the principal climatic elements with emphasis on the physical causes of climate. Theories regarding climatic change will also be discussed.  
*Prerequisite:* METR 1300 or permission of the instructor.

**METR 2301 Climatology Laboratory (1)**  
Techniques in handling climatological data.  
*Corequisite:* METR 2300 or permission of the instructor.

**METR 2310 General Meteorology (4)**  
An overview of meteorology with emphasis on the dynamic aspects of atmospheric behavior. Topics include air masses, fronts, cyclones and anticyclones, winds, theoretical basis for weather forecasting, and mathematical techniques. (3 hr. lec./3 hr. lab.)  
*Prerequisite:* METR 1300 and Math 2412 (may be taken concurrently) or permission of instructor.

**METR 2350 Aviation Meteorology (3)**  
A study and analysis of mid-latitude meteorology in the Northern Hemisphere with an emphasis on those phenomena affecting aircraft operation.  
*Prerequisite:* METR 1300 or permission of instructor.

**METR 2360 Weather Analysis (3)**  
Familiarization with daily weather data and NCEP forecasting products; plotting and analyzing of weather maps; weather map discussion; weather forecasting; daily weather observations. (2 hr. lec./3 hr. lab.)  
*Prerequisite:* METR 1300.

**METR 3360 Air Pollution (3)**  
An examination of the problem of air pollution as seen principally from a meteorological viewpoint. Topics include the terminology and nomenclature of air pollution, the history of air pollution, types of pollutants in the atmosphere, atmospheric dispersion of pollutants, methods of sampling and control, trends in legislation, and cost benefit and risk analysis.  
*Prerequisites:* METR 1300 and Math 1054.

**METR 3369 Planetary Atmospheres (4)**  
The earth's atmosphere as a planetary environment and the origin, evolution and current state of knowledge of the atmospheres of other planets and their prospects for harboring life. (3 hr. lec./3 hr. lab.)  
*Prerequisites:* ASTR 1100 or METR 1300 and MATH 1054.

**METR 3370 Atmospheric Dynamics (4)**  
A mathematical formulation of the physical laws which govern weather processes and atmospheric motion. (3 hr. lec./3 hr. lab.)  
*Prerequisites:* METR 1300, PHYS 2096, MATH 2412 or permission of instructor.

**METR 3371 Atmospheric Thermodynamics (4)**  
The application of thermodynamic principles to the atmosphere: heat, work, internal energy and available energy of the atmosphere; the thermodynamics of water vapor and moist air; dry and moist thermodynamic processes; hydrostatic equilibrium and altimetry; atmosphere stability and convection. (3 hr. lec./3 hr. lab.)  
*Prerequisites:* METR 1300, PHYS 2096, MATH 2412 or permission of instructor.

**METR 3372 Physical Meteorology (3)**  
An examination of the physics of atmospheric phenomena. Topics include wave theory, transfer processes, cloud physics, atmospheric radiation, and remote sensing. Emphasis is placed on the application of physical theory to obtain a better understanding of atmospheric phenomena.  
*Prerequisites:* MATH 2412, METR 1300, PHYS 2096.

**METR 3380 Meteorological Instrumentation (4)**  
Familiarization with the various instruments used to observe the atmosphere; principles of operation, instrument calibration and maintenance, error analysis, observing systems. (3 hr. lec./3 hr. lab.)  
*Prerequisites:* METR 1300 and MATH 1054.

**METR 4301-4302 Meteorology Cooperative Education I and II (3,3)**  
 A practical field experience. Student assigned to an organization involved in meteorological activity such as federal and state government, industry, media, etc. Cooperative employers matched with student's area of interest within field of meteorology. Working hours flexible. Credits earned count as free electives.  
*Prerequisite: Explicit written permission of the instructor.*

**METR 4351-4352 Synoptic Meteorology I and II (4,4)**  
 Understanding the processes which govern the weather; practical application of the predictive equations through use of weather maps; in depth analysis of NCEP forecasting products; extensive plotting and analysis of synoptic charts stressing the three dimensional nature of weather systems; weather forecasting and briefing. (2 hr. lec./6 hr. lab.)  
*Prerequisites: METR 3370 and 3371 or permission of instructor. METR 4351 is a prerequisite to 4352.*

**METR 4370 Advanced Atmospheric Dynamics (3)**  
 Circulation, vorticity, and divergence theorems, theory of Rossby Waves, pressure coordinates, turbulence and diffusion, energy conversions, numerical weather prediction, the general circulation.  
*Prerequisites: METR 3370 and METR 3371 or permission of the instructor.*

## OCEANOGRAPHY COURSES

**OCEN 3453 Introduction to Oceanography (4)**  
 A survey of modern oceanography and its methods including characteristics of seawater, theories of ocean currents and, in general, applications of sciences to the study of the oceans. (3 hr. lec./3 hr. lab.)  
*Prerequisites: Two of the following: BIO 1000, PHYS 2091, CHEM 1083, GEOL 1200, METR 1300 or permission of instructor.*

**OCEN 3463 Marine Science (4)**  
 Impact of global change on the marine realm. The geologic, biologic and general oceanographic nature of beaches, coral reefs, swamps, estuaries, lagoons and tidal flats, continental shelf, deep sea, and mid-ocean rift zones. Major global environmental issues/topics such as sea level change, ocean carbon cycle, and catastrophic events will be discussed. (3 hr. lec./3 hr. lab.)  
*Prerequisite: Oceanography 3453 or permission of instructor.*

**OCEN 4454 Marine Geology (4)**  
 Introduction to the geology of the oceans, including tectonics, geochemistry, shoreline processes, stratigraphy, sedimentology, and related subjects. (3 hr. lec./3 hr. lab.)  
*Prerequisite: OCEN 3453 or permission of instructor.*

**OCEN 4455 Chemical Oceanography (4)**  
 Study of the properties and interactions of chemical substances present in the marine environment, including their reactions at the air-sea and sea-bottom interfaces. (3 hr. lec./3 hr. lab.)  
*Prerequisite: OCEN 3453 or permission of instructor.*

**OCEN 4470 Physical Oceanography (4)**  
 Detailed study of the physical aspects of the oceans including ocean currents, radiation, air-sea interaction, theories of the ocean circulation, geostrophic computations, vorticity. (3 hr. lec./3 hr. lab.)  
*Prerequisite: OCEN 3453 or permission of instructor.*

## RESEARCH, SPECIAL TOPICS AND SEMINARS

**ES 4901-4902 Special Topics in Earth Science (3,3)**  
 Intensive study of specific topics of an advanced nature in the earth sciences. Subject of a semester's work varies.  
*Prerequisite: Permission of the instructor.*

**ES 4953, 4954 Earth Science Seminar I and II (2,2)**  
 The student is asked to pursue a problem of current interest in earth science. The student prepares and presents a paper to a seminar group. Following the presentation, the speaker serves as moderator in a discussion of the subjects.  
*Prerequisite: Senior standing in the Department of Geology and Meteorology.*  
*Writing Emphasis Course*

**ES 4971,2, 3 Independent Research in Earth Science (1, 2, 3)**  
 Each student is asked to pursue a specific current research problem in earth science under the supervision of a faculty member. Approximately forth-five hours of work under the direction of the faculty member is required for each credit hour. May be repeated for credit, however, only 3 credits may be used to fulfill major elective requirement.  
*Prerequisites: Explicit written permission of sponsoring faculty member and department chairperson.*

## HONORS PROGRAM

The Honors Program in Earth and Planetary Environments had been developed for the twofold purposes of recognition of superior achievement and the encouragement of meaningful original research by senior majors. In order to be eligible for admission to the honors program, the student must have maintained a grade-point average of 3.0 in all courses through the end of the junior year as well as a grade-point average of 3.0 in all earth science courses through the end of the junior year.

**ES 4963, 4964 Honors Research Seminar in Earth Science I and II (2,2)**  
 Individual research of an original nature under the supervision of a research sponsor. Results of the work to be presented as a seminar. May be taken in place of but not in addition to ES 4953, 4954.  
*Prerequisites: Earth Science majors, of senior standing, with a grade point average of 3.0 overall as well as in Earth Science courses admitted upon written nomination by a departmental research sponsor and written recommendation by one other departmental faculty member.*  
*Writing Emphasis Course*

## INTERDISCIPLINARY COURSES

The following are found in the Interdisciplinary Courses. (See Index)

**ID 3101-3102 Seminar in Environmental Studies I and II**  
**ID 4101-4102 Seminar in Environmental Studies I and II**