

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)

Chemistry-Physics

Chairperson: Dr. Ronald T. Crisia
C221, (908) 737-3680

B.A. DEGREE - CHEMISTRY

OPTION: GENERAL

This program is designed to prepare the student for graduate study in the various fields of chemistry and for positions in the chemical and related industries.

GENERAL EDUCATION REQUIREMENTS

50-51

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 & 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
Philosophy or Religion		3
Music or Theatre		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 & Mathematics</i>		11
*MATH 1054	Precalculus ##	3
PHYS 2095	Physics I	4
PHYS 2096	Physics II	4
<i>Health/Physical Education</i>		2, 3
ID 1010	Leisure & Rec In Multicultural Society	
OR		
ID 1225	Issues Contemp. Health	3
OR		
Physical Education		2
CONCENTRATION		6
MATH 2411	Calculus I ###	3
MATH 2412	Calculus II	3

ADDITIONAL REQUIREMENTS	7
MATH 3451	Calculus III 3
PHYS 3097	Physics III 4

MAJOR AND CAPSTONE REQUIREMENTS

45

CHEM 1083	Chemistry I	4
CHEM 1084	Chemistry II	4
CHEM 2283	Quantitative Analysis	4
CHEM 2491	Inorganic Chemistry	3
CHEM 3181	Organic Chemistry Lec I	3
CHEM 3182	Organic Chemistry Lec II	3
CHEM 3183	Org. Chemistry Lab & Rec I (WE)	2
CHEM 3184	Org. Chemistry Lab & Rec II	2
CHEM 3284	Instr Meth of Analysis (WE)	4
CHEM 3381	Physical Chemistry Lec I	3
CHEM 3382	Physical Chemistry Lec II	3
CHEM 3383	Physical Chemistry Lab I	2
CHEM 3384	Physical Chemistry Lab II	2
CHEM 4481	Advanced Inorganic Chemistry	3

MAJOR/ GE CAPSTONE COURSE

CHEM 4908	Seminar in Chemistry	3
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FREE ELECTIVES 21-22

(50% of free electives must be taken 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.

Students eligible to take MATH 2412 Calculus II may take that course in place of MATH 2411. In that case, MATH 2412 and MATH 3451 will fulfill the Concentration Requirement and the student may take an additional three credits in Free Electives to total 124 S.H.

B.A. DEGREE - CHEMISTRY

OPTION: PREPROFESSIONAL

The following program is designed for students planning to apply to medical or dental schools. Since many medical schools prefer a core of courses in the humanities, students are advised to consult the catalogs of medical schools to which they will apply and to select courses with departmental advisement which will insure meeting entrance requirements.

GENERAL EDUCATION REQUIREMENTS 50-51

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 & 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
Philosophy or Religion		3
Foreign Languages		3
Music or Theatre		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 & Mathematics</i>		11
*MATH 1054	Precalculus ##	3
BIO 2200	Cell Biology	4
BIO 2400	Genes, Org. & Pop	4
<i>Health/Physical Education</i>		2, 3
ID 1010	Leisure & Rec In Multicultural Society	

OR

ID 1225	Issues Contemp. Health	3
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OR

Physical Education		2
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CONCENTRATION 6

MATH 2411	Calculus I ###	3
MATH 2412	Calculus II	3

*Required Distribution Course

ADDITIONAL REQUIREMENTS 19

MATH 3451	Calculus III	3
PHYS 2095	Physics I	4
PHYS 2096	Physics II	4
PHYS 3097	Physics III	4
BIO 4105	Essentials of Biochemistry	4

MAJOR AND CAPSTONE REQUIREMENTS	32
CHEM 1083 Chemistry I	4
CHEM 1084 Chemistry II	4
CHEM 2283 Quantitative Analysis	4
CHEM 3181 Organic Chemistry Lec I	3
CHEM 3182 Organic Chemistry Lec II	3
CHEM 3183 Org. Chemistry Lab and Rec I (WE)	2
CHEM 3184 Org. Chemistry Lab and Rec II	2
CHEM 3284 Instr Meth of Analysis (WE)	4
CHEM 3381 Physical Chemistry Lec I	3

MAJOR/GE CAPSTONE COURSE	3
CHEM 4908 Seminar in Chemistry	3

FREE ELECTIVES	22-23
(50% of free electives must be taken at the 3000-4000 level).	

TOTAL	124
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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.

Students eligible to take MATH 2412 Calculus II may take that course in place of MATH 2411. In that case, MATH 2412 and MATH 3451 will fulfill the Concentration Requirement and the student may take an additional three credits in Free Electives to total 124 S.H.

B.A. DEGREE - CHEMISTRY

OPTION: CHEMISTRY TEACHER CERTIFICATION

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.

GENERAL EDUCATION REQUIREMENTS	45
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FOUNDATION 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 & Technology	3

DISCIPLINARY & INTERDISCIPLINARY DISTRIBUTION REQUIREMENTS

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

OR	
ANTH 1800 Cultural Anthropology	3

<i>Science & Mathematics</i>	11
* MATH 1054 Precalculus ##	3

PHYS 2095 Physics I	4
PHYS 2096 Physics II	4

<i>Health/Physical Education</i>	3
ID 1225 Issues Contemp. Health	3

*Required Distribution Course

ADDITIONAL REQUIREMENTS 28

MATH 2411 Calculus I ###	3
MATH 2412 Calculus II	3
MATH 3451 Calculus III	3
PHYS 3097 Physics III	4
PSY 2110 Psy of Adolescence	3
BIO 2200 Cell Biology	4
BIO 4105 Essentials of Biochem	4
Select one of the following courses:	
GEOL 1200 Intro Geology	4
OR	
METR 1300 Intro Meteorology	4
OR	
ASTR 1000 Intro Astronomy	4
OR	
OCEN 3453 Intro Oceanography	4

MAJOR AND CAPSTONE REQUIREMENTS 33

CHEM 1083 Chemistry I	4
CHEM 1084 Chemistry II	4
CHEM 2283 Quantitative Analysis	4
CHEM 3181 Organic Chemistry Lec I	3
CHEM 3182 Organic Chemistry Lec II	3
CHEM 3183 Org. Chemistry Lab & Rec I (WE)	2
CHEM 3184 Org. Chemistry Lab & Rec II	2
CHEM 3284 Instr. Methods of Analysis (WE)	4
CHEM 3381 Physical Chemistry Lec I	3
CHEM 3901 Independent Chemistry Research I	1

MAJOR/GE CAPSTONE COURSE	3
CHEM 4908 Seminar in Chemistry	3

PROFESSIONAL EDUCATION 27

<i>Sophomore Level</i>	
EMSE 2801 Intro Field Experience K-12	3

<i>Junior Level</i>	
EDUC 3000 Curriculum Eval. & Learner	3
EDUC 3401 Language Arts/ Reading K-12	3
EMSE 3230 Science Education K-12	3
EMSE 3801 Field Exp Subj Area K-12	2
EMSE 3903 Eng Lang Learn In Amer Soc	1

<i>Senior Level</i>	
EMSE 4801 Prof Intern/Subj Area K-12	9

<i>Professional/GE Capstone</i>	
EDUC 4000 Teacher and Classroom	3

TOTAL	133
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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 as Free Electives to total 133 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 133 S.H. Students in teacher preparation programs must take the three credits in a liberal arts discipline.

Students eligible to take MATH 2412 Calculus II may take that course in place of MATH 2411 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.

B.S. DEGREE - CHEMISTRY

OPTION: EXPANDED (ACS CERTIFIED)

For students who plan to enter professional careers immediately after graduation or who plan to undertake graduate study, the American Chemical Society (ACS) requires a curriculum for professional training that includes a series of advanced courses. The curriculum for this option is based upon the ACS guidelines. Students completing this program are certified by the ACS and may become members of the ACS immediately upon graduation. Students desiring to complete the expanded option should consult the department chairperson.

GENERAL EDUCATION REQUIREMENTS

50-51

FOUNDATION 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 & 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
Philosophy or Religion			3
Foreign Languages			3
Music or Theatre			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 & Mathematics</i>			11
*MATH	1054	Precalculus ##	3

PHYS	2095	Physics I	4
PHYS	2096	Physics II	4

<i>Health/Physical Education</i>			2, 3
ID	1010	Leisure & Rec In Multicultural Society	3

OR			
ID	1225	Issues Contemp. Health	3
OR			
Physical Education			2

CONCENTRATION

6

MATH	2411	Calculus I ###	3
MATH	2412	Calculus II	3
*Required Distribution Course			

ADDITIONAL REQUIREMENTS

7

MATH	3451	Calculus III	3
PHYS	3097	Physics III	4

MAJOR AND CAPSTONE REQUIREMENTS

57

CHEM	1083	Chemistry I	4
CHEM	1084	Chemistry II	4
CHEM	2283	Quantitative Analysis	4
CHEM	2491	Inorganic Chemistry	3

CHEM	3181	Organic Chemistry Lec I	3
CHEM	3182	Organic Chemistry Lec II	3
CHEM	3183	Organic Chemistry Lab/Rec I (WE)	2
CHEM	3184	Organic Chemistry Lab/Rec II	2
CHEM	3284	Instr. Methods of Analysis (WE)	4
CHEM	3381	Physical Chemistry Lec I	3
CHEM	3382	Physical Chemistry Lec II	3
CHEM	3383	Physical Chemistry Lab I	2
CHEM	3384	Physical Chemistry Lab II	2
CHEM	4481	Adv. Inorganic Chemistry	3
CHEM	4483	Inorganic Chemistry Lab	3
CHEM	4581	Biochemistry	3
4000 level Chemistry lab course			3
One 4000 level lecture courses in Chemistry, Physics, Math, or Earth Sciences			3

MAJOR/GE CAPSTONE COURSE

CHEM	4908	Seminar in Chemistry	3
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FREE ELECTIVES

13-14

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

TOTAL

128

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 128 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 128 S.H.

Students eligible to take MATH 2412 Calculus II may take that course in place of MATH 2411. In that case, MATH 2412 and MATH 3451 will fulfill the Concentration Requirements and the student must take an additional three credits as Free Electives to total 128 S.H.

CHEMISTRY MINOR**REQUIRED COURSES**

11

CHEM	1083	Chemistry I	4
CHEM	1084	Chemistry II	4
CHEM	2491	Inorganic Chemistry	3

ELECTIVES

9-12

Select one set listed below:

Set 1:			
CHEM	3181	Organic Chemistry Lec I	3
CHEM	3182	Organic Chemistry Lec II	3
Upper-division Chemistry course			3-4
(except CHEM 3183/3184)			

Set 2:			
CHEM	3381	Physical Chemistry Lec I	3
CHEM	3382	Physical Chemistry Lec II	3
Upper-division Chemistry course			3-4

Set 3:			
CHEM	2283	Quantitative Methods of Analysis	4

CHEM	3284	Instrumental Methods of Analysis	4
Upper-division Chemistry course			3-4

Set 4:			
CHEM	4481	Advanced Inorganic Chemistry	3

CHEM	4483	Inorganic Chemistry Laboratory	3
Upper-division Chemistry course			3-4

TOTAL

20-23

PHYSICS MINOR**REQUIRED COURSES**

12

PHYS	2095	Physics I	4
PHYS	2096	Physics II	4
PHYS	3097	Physics III	4

ELECTIVES

PHYS	4592	Modern Physics	4
PHYS	4593	Landmark Phys of the 20 th Century	3
PHYS	4901	Physics Independent Research	1-3

TOTAL

18-22

CHEMISTRY COURSES**GENERAL**

CHEM 1010 Preparatory Chemistry (4) Basic introduction to elementary chemical principles, language, calculations, and techniques. Modular approach stresses mastery of concepts. May not be used for credit toward graduation by chemistry majors (all options). (3 hr. lec./3 hr. lab.)
Prerequisite: MATH 1000
Approved General Education Distribution Course

CHEM 1030 Essentials of Chemistry (4) Fundamental concepts in general, organic and biochemistry are covered, providing examples of chemistry in health care and real life applications. Problem solving and critical scientific thought stressed. (3 hr. lec./3 hr. lab/1 hr. recitation.)
Prerequisites: High School chemistry or equivalent and MATH 1000, or permission of instructor. Required for the Occupational Therapy Program.
Approved General Education Distribution Course

CHEM 1083 Chemistry I (4)

A thorough discussion of the fundamental principles of general and inorganic chemistry such as atomic structure, ionic and covalent bonding, chemical calculations, thermodynamics and gases. Mathematical relationships and problem-solving are stressed. It is essential that the student have competence in elementary algebra. (3 hr. lec./3 hr. lab./1 hr. recitation)
Corequisite: MATH 1054.

Prerequisites: High school chemistry or equivalent course and MATH 1000.
Approved General Education Distribution Course

CHEM 1084 Chemistry II (4)

A continuation of Chemistry I (CHEM 1083). A thorough discussion of the basic principles of general and inorganic chemistry such as solid and liquid states, solutions, chemical kinetics and equilibrium, acid/base theories and electrochemistry. Mathematical relationships and problem-solving are stressed. (3 hr. lec./3 hr. lab./1 hr. recitation)

Prerequisites: MATH 1054, CHEM 1083 or equivalent course with a grade of "C" or better.
Approved General Education Distribution Course

CHEM 1200 Chemistry In Your World (3)

A modular approach to the impact of chemistry and its fundamental principles on our everyday, real world experiences. Applications, issues and concerns are explored. May not be used for credit toward graduation by chemistry majors. (3 hr. lec.)

Prerequisite: MATH 1000

Approved General Education Distribution Course

ORGANIC**CHEM 2180 Principles of Organic Chemistry (4)**

A terminal one semester course for the non-major dealing with structure and reactions of organic compounds. Industrial and medical applications are included. (3 hr. lec./3 hr. lab.)
Prerequisites: CHEM 1084 or permission of the instructor.

CHEM 3181 Organic Chemistry I (3)

A first course in organic chemistry. The nature and reactions of organic compounds are studied via a functional group organization. Atomic and molecular orbital theory; aliphatic, aromatic, alicyclic; reaction mechanisms; resonance; stereoisomerism; conformational analysis; and free radicals. (3 hr. lec./1 hr. rec.)

Prerequisite: CHEM 1084 or permission of the instructor.

Corequisite: CHEM 3183.

CHEM 3182 Organic Chemistry II (3)

A continuation of CHEM 3181. The nature and reactions of organic compounds are studied via a functional group organization. Atomic and molecular orbital theory; aliphatic, aromatic, alicyclic, reaction mechanisms; resonance, stereoisomerism, conformational analysis and free radicals. (3 hr. lec./1 hr. rec.)

Prerequisites: CHEM 3181, CHEM 3183 with a minimum grade of "C" or permission of the instructor.

Corequisite: CHEM 3184.

CHEM 3183 Organic Chemistry Laboratory and Recitation I (2)

An introduction to the preparation, purification and analysis of the major classes of organic compounds. Use of both traditional and electronic technical literature are required. Approaches to problem solving are discussed in recitation. (4 hr. lab./1 hr. lec.)

Corequisite: CHEM 3181 or permission of the instructor.

Writing Emphasis Course

CHEM 3184 Organic Chemistry Laboratory and Recitation II (2)

A continuation of CHEM 3183 with more emphasis on preparative reactions and instrumental characterization techniques. Computer molecular modeling and computation will be used to predict properties of some organic compounds. (4 hr. lab./1 hr. lec.)

Corequisite: CHEM 3182.

Prerequisite: CHEM 3183 with a minimum grade of "C" or permission of the instructor.

CHEM 4150/5150 Spectrometric Identification of Organic Compounds (3)

Determination of the structure of organic compounds by analysis on infrared, ultra-violet, nuclear magnetic resonance and mass spectra. Extensive use of published spectra of "unknowns." (3 hr. lec.)

Prerequisites: CHEM 3182, CHEM 3382 or permission of instructor.

CHEM 4181 Organic Chemistry Lecture III (3)

A continuation in depth of the study of organic compounds and syntheses from a mechanistic approach. (3 hr. lec.)

Prerequisite: CHEM 3182.

CHEM 4182 Advanced Organic Preparations (3)

A laboratory course designed to give the student a broader background in the synthesis of organic compounds. (1 hr. lec./6 hr. lab.)

Prerequisite: CHEM 3184.

CHEM 4183 Introduction to Physical Organic Chemistry (3)

The application of physical chemical principles to the study of organic compounds. An introduction to conformational analysis, molecular orbital theory and resonance concepts. (3 hr. lec.)

Prerequisites: CHEM 3182 and CHEM 3382.

CHEM 4184/5184 Introduction to Molecular Modeling and Its Applications (3)

Introduction to the use of computational chemistry and molecular modeling as tools for the solution of real-world research problems in chemistry and biochemistry. Students must have a fundamental understanding of the structural organic chemistry, thermodynamics, kinetics, elementary biochemistry and the general principles of quantum chemistry. (3 hr. lec.)

Prerequisites: CHEM 3182, CHEM 3382 or permission of instructor.

ANALYTICAL**CHEM 2283 Quantitative Analysis (4)**

The theory, calculations, and techniques of gravimetry, titrimetry and photometric methods of analysis. Equilibria of acid/base, redox and complexation reactions are emphasized. Development of analytical laboratory skills is stressed. (3 hr. lec./5 hr. lab.)

Prerequisite: CHEM 1084 or equivalent with a minimum grade of C.

CHEM 3284/5284 Instrumental Methods of Analysis (4)

General applications of modern instruments to the detection, identification and estimation of chemical elements and compounds. Laboratory exercises in the use of a variety of instruments.

(3 hr. lec./3 hr. lab.)

Prerequisites: CHEM 2283, MATH 2411, PHYS 3097 or permission of instructor.

Writing Emphasis Course

CHEM 4285/5285 Chemical Separation Methods (3)

Provides background in modern chemical separation methods. Theory, instrumentation and application of distillation, selective complexation, solvent extraction and various chromatographic methods. Major emphasis will be placed on high performances - thin layer, liquid and gas chromatographic techniques. Experience with many modern and sophisticated chromatographic instruments. (3 hr. lec./lab.)

Prerequisites: CHEM 2283, 3284, 3382 or permission of instructor.

PHYSICAL**CHEM 3381 Physical Chemistry Lecture I (3)**

The basic theories behind the behavior of matter discussed in great detail for deeper understanding of thermodynamics, solutions, the states of matter, chemical equilibrium and electrochemistry. (3 hr. lec.)

Prerequisites: CHEM 1084, PHYS 2096, and MATH 3451 or permission of instructor.

CHEM 3382 Physical Chemistry Lecture II (3)

A continuation of CHEM 3381 which is prerequisite. (3 hr. lec.)

CHEM 3383 Physical Chemistry Laboratory and Recitation I (2)

Laboratory experience to illustrate theoretical concepts of physical chemistry through experimental measurement. Experience with a wide range of sophisticated chemical equipment. Recitation for integration of problem solving and lecture and laboratory applications. (4 hr. lab./1 hr. recitation)

Prerequisite: CHEM 2283.

Corequisite: CHEM 3381 or permission of instructor.

CHEM 3384 Physical Chemistry Laboratory and Recitation II (2)

Continuation of CHEM 3383 with increased emphasis on spectroscopic methods for obtaining various kinetic, thermodynamic and structural information about chemical compounds and systems. (4 hr. lab./1 hr. recitation)

Prerequisite: CHEM 3383.

Corequisite: CHEM 3382 or permission of instructor.

CHEM 4381 Physical Chemistry III - Chemical Thermodynamics (3)

An advanced treatment of the laws of thermodynamics, and rigorous application to problems of chemical interest including heats of reaction, spontaneity of chemical reactions and phase changes. (3 hr. lec.)

Prerequisites: CHEM 3382 and MATH 3452 or permission of instructor.

CHEM 4382 Physical Chemistry IV- Quantum Chemistry (3)

Development of the mathematical and physical theory of Quantum Mechanics and application to the structure and properties of atoms and molecules. The Schroedinger Equation. Variation Theory and Perturbation Theory. (3 hr. lec.)

Prerequisites: CHEM 3382 and MATH 3452 or permission of instructor.

INORGANIC**CHEM 2491 Inorganic Chemistry (3)**

Descriptive chemistry of the Main Group elements, transition metals and rare earth metals. Emphasis on the chemical and physical properties of the elements. Discussion of periodic law, basics of nuclear chemistry and natural occurrence and industrial uses of the elements and their compounds. (3 hr. lec.)

Prerequisites: MATH 2411; "C" or better in CHEM 1084; or permission of the instructor.

CHEM 4481 Advanced Inorganic Chemistry (3)

Periodicity and stereochemistry of the Main Group Elements and comparative group properties. Stereochemistry and coordination chemistry of transition metals. Discussion of the theories of bonding in transition metal complexes and the Main Group elements. Nonaqueous solvents and reaction mechanisms in inorganic chemistry. (3 hr. lec.)

Prerequisites: CHEM 3284, CHEM 2491, CHEM 3381, CHEM 3182, or permission of instructor.

Corequisite: CHEM 3382 or permission of instructor.

CHEM 4483 Inorganic Chemistry Laboratory (3)

Modern methods of synthesizing inorganic and organometallic compounds including electrolytic, high temperature and vacuum-line preparations. The study of the prepared compounds using a variety of techniques including infra-red, visible, ultraviolet spectroscopies, nuclear magnetic resonance, chromatographic, x-ray analysis and electro-analytical methods of analysis. Equilibria of acid/base, redox and complexation reactions are emphasized. Development of analytical laboratory skills is stressed. (1 hr. lec./6 hr. lab.)

Prerequisite: CHEM 4481.

BIOCHEMISTRY**CHEM 4581 Biochemistry (3)**

Molecular mechanisms of biological processes are explored with an emphasis on kinetic, thermodynamic and solution properties of macromolecules. (3 hrs. lec)

Prerequisites: CHEM. 2283 and CHEM. 3381; *Corequisite* CHEM.3382

SEMINARS AND INDEPENDENT STUDY

A maximum of 12 credits of chemistry research (CHEM 3901-4 and CHEM 4905-6) may be taken. Only 6 credits may be applied towards the total degree credits required for graduation.

CHEM 3500 Chemistry-Physics Cooperative Education Internship (1-3)

Selected majors in Chemistry and Chemistry-Physics test theories learned in the classroom with on-the-job experience in career related areas. Assignments and placements are arranged by the department in cooperation with the Office of Cooperative Education. Seminars, student reports and term papers required. Credits earned cannot be used to fulfill the major or cognate requirements. Application to the Coop Internship must be made during advanced registration.

Prerequisites: CHEM 1083-4, CHEM 2283, CHEM 3181, CHEM 3183, *good academic standing junior or senior status and permission of the department cooperative education committee.*

CHEM 3901-4 Independent Chemistry Research I-IV (1-2)

Research problems in chemistry investigated under direction of a faculty member. Students completing two semesters of independent study under the same project director must submit a written or oral report to the departmental research committee. May be taken 4 times for credit, 1-2 credits per semester.

Prerequisites: 8 credits in chemistry plus 12 credits in 2000 level science or mathematics courses, *sponsoring faculty member and approval of department chairperson.*

CHEM 4905-6 Senior Honors Research I and II (3,3)

Research problems in chemistry investigated under the direction of a faculty member. A progress report must be submitted to the faculty sponsor before the end of each semester. An oral report to be made before the departmental research committee at end of second semester. Seniors wishing to qualify for honors with their chemistry degree must also submit a thesis or publishable report to the departmental research committee before completing second term.

Prerequisites: CHEM 3381, 3383, *a sponsoring faculty member, and approval of department chairperson.* CHEM 4905 is prerequisite to 4906.

CHEM 4908 Seminar in Chemistry (3)

After an introduction to manual and computer-assisted techniques in literature searching, the student will choose a topic. A written paper will be prepared in electronic format and an oral presentation with computer graphics made using student's skills and knowledge based in Chemistry and related disciplines. Satisfies the General Education Capstone requirement for chemistry majors. (3 hrs. lec)

Prerequisite: All GELAP requirements & permission of instructor

CHEM 4909 Special Topics in Chemistry (3)

Study of current topics in Chemistry which are not presented in regular courses. The subject matter will vary. Topics will be announced by the department. Course may be repeated for a maximum of 6 credits. (3 hr. lec. and/or lab.)

Prerequisite: 25 credits in Chemistry and permission of instructor.

PHYSICS COURSES**GENERAL****PHYS 1000 Principles of Contemporary Physics (4)**

A one-semester survey of important principles of physics with applications to a variety of disciplines in modern technological society. Designed for non-science majors. (3 hr. lec/3 hr. lab)

PHYS 2081, 2082 Physics Lecture I and II (3,3)

Duplicates the non-laboratory portions of PHYS 2091, 2092, respectively. Non-laboratory courses restricted to non-matriculated students wishing to transfer credits to institutions not requiring laboratory. Students meet with PHYS 2091, 2092 and are responsible for all non-laboratory assignments of those courses. (3 hr. lec./1 hr. recitation)

Prerequisites: same as required by corresponding laboratory courses: PHYS 2091, 2092

PHYS 2091 General Physics I (4)

Mechanics, wave motion and sound. PHYS 2091/2092 is an algebra-trigonometry based sequence designed to give the student a general understanding of the laws and principles of physics. Students may not receive credit for both PHYS 2091 and 2095. (3 hr. lec./3 hr. lab./1 hr. recitation)

Prerequisite: MATH 1054 or equivalent.

Approved General Education Distribution Course

PHYS 2092 General Physics II (4)

Continuation of the PHYS 2091/2092 sequence, and some modern physics, electricity and magnetism, optics, and modern physics. Students may not receive credit for both PHYS 2092 and PHYS 3097. (3 hr. lec./3 hr. lab./1 hr. recitation)

Prerequisite: PHYS 2091.

Approved General Education Distribution Course

PHYS 2095 Physics I (4)

Kinematics and dynamics of particles and extended bodies. PHYS 2095 is a calculus based introduction to the fundamentals of classical physics. Students may not receive credit for both PHYS 2095 and PHYS 2091. (3 hr. lec./3 hr. lab./1 hr. recitation.)

Prerequisite: MATH 2411.

Corequisite: MATH 2412.

Approved General Education Distribution Course

PHYS 2096 Physics II (4)

Continuation of the Physics sequence. Equilibrium and elasticity, gravity, fluid mechanics, wave motion and sound, thermodynamics, and optics. PHYS 2096 is a calculus based introduction to the fundamentals of classical physics. (3 hr. lec./3 hr. lab./1 hr. recitation.)

Prerequisites: PHYS 2095, MATH 2412.

Approved General Education Distribution Course

PHYS 3097 Physics III (4)

PHYS 3097 is a calculus based continuation of the Physics sequence. Electricity and magnetism, Maxwell's equations and electromagnetic waves. Students may not receive credit for both PHYS 3097 and 2092. (3 hr. lec./3 hr. lab./1 hr. recitation.)

Prerequisites: PHYS 2096, MATH 3451.

MODERN PHYSICS**PHYS 4592 Modern Physics (4)**

A rigorous survey of atomic and nuclear physics, early experimentation, incompatibility of experimental findings and classical theory, and quantum and wave mechanics approaches to understanding modern physics. (3 hr. lec./3 hr. lab.)

Prerequisites: PHYS 2095-2096 or permission of instructor.

PHYS 4593 Landmark Physics of the 20th Century (3)

A rigorous survey of important theories of the twentieth century selected from Einstein's special and general theories of relativity, nuclear physics, statistical mechanics, condensed matter physics, superconductivity, superfluidity, and other topics of current interest. (3 hr. lec.)

Prerequisites: PHYS 2095-2096 or permission of instructor.

INDEPENDENT STUDY**PHYS 4901 Independent Physics Research (1-3)**

Research problems involving current physics-related topics, either pure physics or interdisciplinary in nature, to be investigated under the guidance of a faculty director or team of co-directors. May be repeated for credit, up to a total of six credits. Students completing two semesters of independent study under the same project director(s) must submit a formal written report.

Prerequisites: PHYS 2096, a sponsoring faculty member(s), and approval of the department chairperson(s).