Department of
PHYSICS & ASTRONOMY
THE UNIVERSITY OF UTAH

Undergraduate Handbook

Fall 2019

CONTACT INFORMATION

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UNDERGRADUATE INFORMATION

Students who love math and want to use it to solve real problems find a home in physics. Students who are interested in science, and discover that they want to know the fundamental principles behind it all, find their way to physics. Students interested in engineering, who want both greater understanding and a more challenging field, change their major to physics. Students seeking a technical degree with broadest possible background discover physics is the place for them.

--University of Utah Physics Alumnus, 2014

PROGRAM DESCRIPTION

A degree in physics is a 4-year degree starting with calculus. All of the physics degrees and emphases require a calculus-based introductory physics sequence with labs, a course in modern physics, thermodynamics, statistical mechanics, a practical physics course, and an advanced physics course. Most degrees and emphases also require a course in classical mechanics, advanced electrodynamics, and quantum mechanics. The degrees differ in the number of semesters of each of these courses, the number and type of required practical courses, and the requirements for the depth and breadth courses. All degrees and emphases also require calculus I - III, linear algebra and differential equations. Most degrees require partial differential equations and complex variables, or equivalent.

All of the degrees and emphases in physics have similar requirements in the first two years, so it is possible to explore the major before making a final decision on the degree program or emphasis. After this time, it is still possible to change degree programs, but there are likely to be set-backs.

ADVISING

We encourage students to make an appointment with their advisor regarding major declaration, course planning, mandatory advising visits, involvement opportunities, including research, prepare for post-graduation, or any other concerns. Students should see their academic advisor at least once a year, though students are welcome to come by any time they have questions.

For quick questions, no appointment is necessary to meet with the undergraduate advisor, simply stop by during drop-in advising office hours which are posted at physics.utah.edu/advising-schedule.

TRANSFER STUDENTS

Transfer students are encouraged to contact the advisors early in their academic career, even prior to admission to the University of Utah. Many of the prereq requirements for the degree can be completed at transfer institutions.

Credits transfered from USHE and local partner institutions will be articulated automatically. Credits from out-of-state institutions will need to be evaluated for equivalency by the relevant department.

Math courses can be evaluated by submitting the requested information to the Mathematics Department's transfer evaluation form, http://www.math.utah.edu/undergrad/registration.php

Studnets with advanced physics courses should plan on bringing transcripts, course descriptions and syllabi to their initial advisor meeting.

Physics majors who need transfer courses evaluated for general education or bachelor's degree requirements may email the course description and syllabus to uadvising@physics.utah.edu.

AP CREDIT

Students with AP Physics test scores are encouraged to take the PHYS 3210/3220 introductory physics sequence. However, with advisor approval, a score of 4 or 5 on the AP Physics C Mech exam will place students out of PHYS 2210 and a score of 4 or 5 on the AP Physics C E&M exam will place students out of PHYS 2220. AP Physics 1 and AP Phyiscs 2 do not count towards the major. Students who took any of the AP Physics exams are encouraged to submit their lab notebook for evaluation.

For students in a degree program that requires chemistry, an AP Chemistry score of 4 will place students out of CHEM 1210 and an AP Chemistry score of 5 will place students out of both CHEM 1210 and CHEM 1220. Studnets who took the AP Chemistry exam are encouraged to take their lab notebook to the Chemistry Department for evaluation.

Students with AP Calculus exam scores are placed into their math classes according to the chart below.

Test	Score	Course
AB	3	MATH 1210
AB	4	MATH 1220 or 1250
AB	5	MATH 1250 or 1220
BC	3	MATH 1220
BC	4 or 5	MATH 1260 or 2210

Students with IB HL Math scores should submit their syllabi to the Mathematics Department's transfer evaluation form, http://www.math.utah.edu/undergrad/registration.php

GRADUATION REQUIREMENTS

UNIVERSITY REQUIREMENTS

Minimum University Requirements

Total Credits Requirement	122
Upper Division Hours (3000 Level or Higher at U of U)	40
U of U Residence Hour Requirement	30
(20 of last 30 hours must be earned in residence. Independent Study credits do not count as resident credits.)	
General Education Credits	See Below
Minimum GPA	2.0
Completion of Major Requirements	See Below
Completion of Minor (if desired)	See Dept.

General Education Requirements

- **American Institutions (AI):**
  HIST 1700 or ECON 1740 or POLS 1100
- **Writing (WR):**
  WRTG 2010
- **Quantitative Reasoning (QA/QB):**
  Calculus I fills both the QA and QB requirements (or waived by AP credit)
- **Intellectual Explorations (IE):**
  - 2 Fine Arts (FF)
  - 2 Humanities (HF)
  - 2 Social Sciences (BF)
  - 2 Life/Physical Science (SF)
    Fulfilled by the major

Bachelor Degree Requirements

- **Upper Division Communication/Writing (CW):**
- **Diversity Requirement (DV):**
- **International Requirement (IR):**
- **B.S. or B.A. Requirements:**
  Physics major courses fulfill both B.S. QI requirements. The B.A. requirement will be filled with a fourth semester of a upper division language course or credit by special exam.

PHYSICS & ASTRONOMY DEPARTMENT REQUIREMENTS

In addition to the required coursework outlined in this publication, all physics majors are required to:

1. Receive a "C-" or better in all major and minor courses. Teaching majors must receive a "C" or better in all courses required for the teaching endorsement.
2. Maintain a minimum GPA of 2.0 in major courses. Teaching majors must maintain a minimum GPA of 3.0 to be admitted to the licensure program.
3. Complete at least 12 upper division credit hours of University of Utah Physics and/or Astronomy courses for the major, or 6 for the minor.

REQUIREMENT CHANGES

Students are generally held to the Department of Physics & Astronomy graduation requirements in place at the time they declare their major. Students who interrupt their studies may be held to the graduation requirements in place when they re-enter the University. Graduation requirements shown on this sheet are deemed to be reliable, however, it is the student's responsibility to check with the advisor periodically concerning possible changes or corrections.

NOTES AND PLANNING:

Fall	Spring	Summer
Fall	Spring	Summer
Fall	Spring	Summer
Fall	Spring	Summer
Fall	Spring	Summer

PHYSICS MAJOR B.S./B.A.

The Physics Bachelor's Degree is designed to give students the deepest and broadest understanding of Physics to lay a firm foundation for graduate work in Physics or related discipline. The hallmark course sequences of this program include the two-semester classical physics sequence, PHYS 4410/4420, and the two-semester quantum physics sequence, PHYS 5450/5460. These two sequences provide advanced and in-depth instruction in topics that are the most important for success in physics graduate studies. This degree also provides practical experience in laboratory techniques, writing, and computer programming.

Core Physics Courses – Required for All Majors

	PHYS 1970	Undergrad Seminar I	1
	PHYS 1980	Undergrad Seminar II	1
	PHYS 2210/3210	Physics I for Scientists & Engineers/Physics I for Scientists	4
	PHYS 2215	Physics I Lab for Sci & Eng	1
	PHYS 2235	Comp Lab for Physicists	1
	PHYS 2220/3220	Physics II for Scientists & Eng/ Physics II for Scientists	4
	PHYS 2225	Physics II Lab for Sci & Eng	1
	PHYS 3740	Intro to Quantum Theory and Relativity	3
	PHYS 3760	Thermodyamics and Statistical Mechanics	3

Core Math Courses – Required for All Majors[1]

	MATH 1210	Calculus I	4
	MATH 1220	Calculus II	4
	MATH 2210[2]	Calculus III	3
	MATH 2250[3]	Differential Equations and Linear Algebra	4
	MATH 3150/5410	Partial Differential Equations for Eng/Differential Equations	2/4
	MATH 3160/4200	Applied Complex Variables/ Complex Variables	2/3

[1]Students in the Biomedical Physics degree and the Physics Teaching degree may have modified requirements.
[2]Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.
[3]Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

See the undergraduate advisor about approval for additional courses.

Advanced Physics Courses – Physics

	PHYS 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4
	PHYS 3730	Intro to Computing in Physics	4
	PHYS 4410	Classical Physics I	4
	PHYS 4420	Classical Physics II	4
	PHYS 5450	Intro to Quantum Mechanics	4

Advanced Physics Electives – Physics

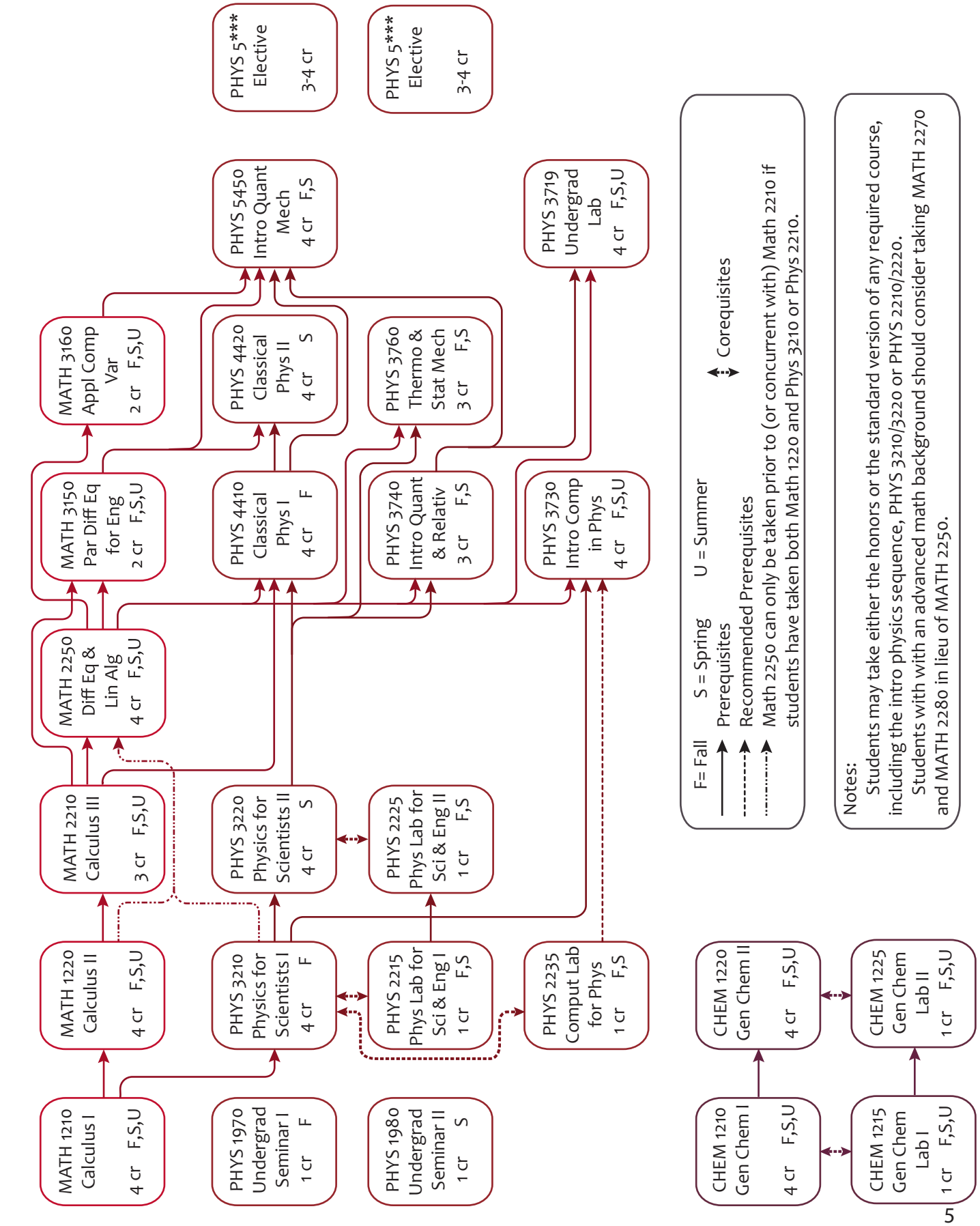
Select two courses from the list below:

	PHYS 5110	Intro to Nuclear and Particle Physics	3
	PHYS 5210	Intro to Gravitation	3
	PHYS 5460	Quantum Mechanics and Statistical Mechanics	4
	PHYS 5510	Solid State Physics I	3
	PHYS 5520	Solid State Physics II	3

Chemistry Courses – Physics

	CHEM 1210/1211	General Chemistry I/Honors General Chemistry I	4
	CHEM 1215/1240	Gen ChemLab I/Honors Gen Chem Lab I	1
	CHEM 1220/1221	General Chemistry II/Honors General Chemistry II	4
	CHEM 1225/1241	Gen ChemLab II/Honors Gen Chem Lab II	1

B.S./B.A. PHYSICS MAJOR



PHYSICS MAJOR APPLIED PHYSICS

B.S./B.A.

The Physics Bachelor's Degree with an Applied Physics emphasis is intended for students who are planning on doing graduate research in experimental physics, who are interested in graduate school in related areas such as engineering or earth science, who are thinking about law school, or who plan on going directly into industry after graduating with their Bachelor's. By reducing the total number of semesters in classical and quantum physics from four to two, the Applied Physics emphasis allows students more time for additional practical courses. Students choose advanced and practical electives to best meet their goals and interests.

Core Physics Courses – Required for All Majors

	PHYS 1970	Undergrad Seminar I	1
	PHYS 1980	Undergrad Seminar II	1
	PHYS 2210/3210	Physics I for Scientists & Engineers/Physics I for Scientists	4
	PHYS 2215	Physics I Lab for Sci & Eng	1
	PHYS 2235	Comp Lab for Physicists	1
	PHYS 2220/3220	Physics II for Scientists & Eng/ Physics II for Scientists	4
	PHYS 2225	Physics II Lab for Sci & Eng	1
	PHYS 3740	Intro to Quantum Theory and Relativity	3
	PHYS 3760	Thermodyamics and Statistical Mechanics	3

Core Math Courses – Required for All Majors[1]

	MATH 1210	Calculus I	4
	MATH 1220	Calculus II	4
	MATH 2210[2]	Calculus III	3
	MATH 2250[3]	Differential Equations and Linear Algebra	4
	MATH 3150/5410	Partial Differential Equations for Eng/Differential Equations	2/4
	MATH 3160/4200	Applied Complex Variables/ Complex Variables	2/3

[1]Students in the Biomedical Physics degree and the Physics Teaching degree may have modified requirements.
[2]Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.
[3]Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

See the undergraduate advisor about approval for additional courses.

Advanced Physics Courses – Applied Physics

	PHYS 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4
	PHYS 3730	Intro to Computing in Physics	4
	PHYS 5010	Classical Mechanics and Quantum Mechanics	4
	PHYS 5020	Electricity and Magnetism and Quantum Mechanics	

Advanced Physics Electives – Applied Physics

Select one course from the list below:

	PHYS 5110	Intro to Nuclear and Particle Physics	3
	PHYS 5210	Intro to Gravitation	3
	PHYS 5510	Solid State Physics I	3

Practical Physics Electives – Applied Physics

Select two courses from the list below:

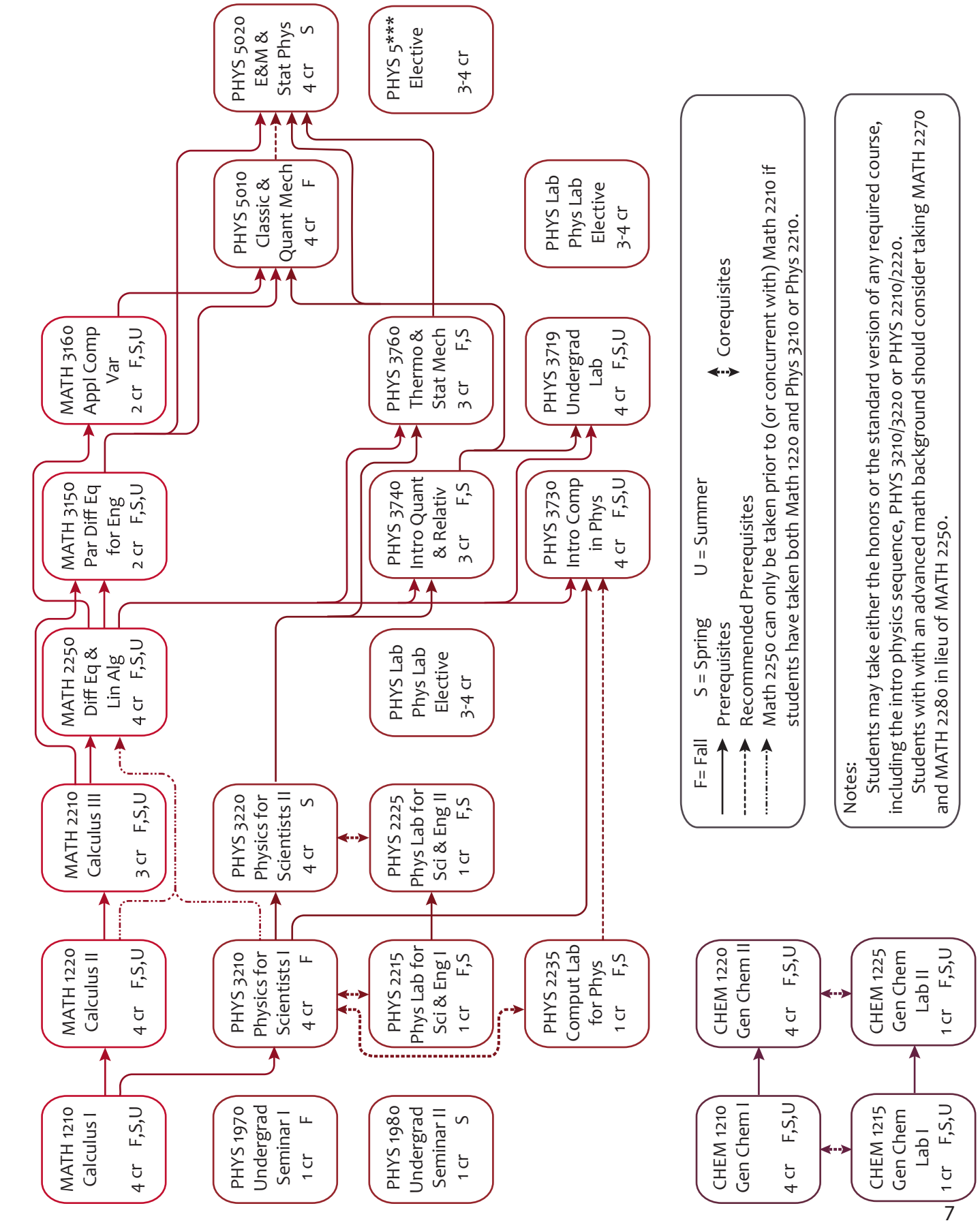
	PHYS 3330	Digital Audio and Video	3
	PHYS 3410	Found of Modern Optics	4
	PHYS 3610	Electronics for Sci Instrumentation	3
	PHYS 3620	Data Aquisition for Sci Instrumentation	3
	PHYS 4060	Observational Astronomy	3
	PHYS 5760	Princ of Physical Measurement and Instrumentation	3

Chemistry Courses – Applied Physics

	CHEM 1210/1211	General Chemistry I/Honors General Chemistry I	4
	CHEM 1215/1240	Gen ChemLab I/Honors Gen Chem Lab I	1
	CHEM 1220/1221	General Chemistry II/Honors General Chemistry II	4
	CHEM 1225/1241	Gen ChemLab II/Honors Gen Chem Lab II	1

B.S./B.A.

PHYSICS MAJOR
APPLIED PHYSICS



PHYSICS MAJOR ASTRONOMY & ASTROPHYSICS

B.S./B.A.

The Physics Bachelor's Degree with an Astronomy & Astrophysics Emphasis prepares students for graduate school in Astronomy or Astrophysics. At its core, it is the same sequence of courses that are in the Physics Bachelor's Degree, but the depth and breadth courses have been replaced with astronomy electives, allowing students to study astronomy as an undergraduate. Because it is a strong physics degree, students with this degree also attend graduate school in other areas of physics, or related fields.

Core Physics Courses – Required for All Majors

	PHYS 1970	Undergrad Seminar I	1
	PHYS 1980	Undergrad Seminar II	1
	PHYS 2210/3210	Physics I for Scientists & Engineers/Physics I for Scientists	4
	PHYS 2215	Physics I Lab for Sci & Eng	1
	PHYS 2235	Comp Lab for Physicists	1
	PHYS 2220/3220	Physics II for Scientists & Eng/ Physics II for Scientists	4
	PHYS 2225	Physics II Lab for Sci & Eng	1
	PHYS 3740	Intro to Quantum Theory and Relativity	3
	PHYS 3760	Thermodyamics and Statistical Mechanics	3

Core Math Courses – Required for All Majors[1]

	MATH 1210	Calculus I	4
	MATH 1220	Calculus II	4
	MATH 2210[2]	Calculus III	3
	MATH 2250[3]	Differential Equations and Linear Algebra	4
	MATH 3150/5410	Partial Differential Equations for Eng/Differential Equations	2/4
	MATH 3160/4200	Applied Complex Variables/ Complex Variables	2/3

[1]Students in the Biomedical Physics degree and the Physics Teaching degree may have modified requirements.
[2]Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.
[3]Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

See the undergraduate advisor about approval for additional courses.

Advanced Physics Courses – Astronomy & Astrophysics

	ASTR 2500	Found of Astronomy	3
	PHYS 4410	Classical Physics I	4
	PHYS 4420	Classical Physics II	4
	PHYS 5450	Intro to Quantum Mechanics	4

Topical Astronomy Electives – Astronomy & Astrophysics

Select two courses from the list below:

	ASTR 4070	Extragalactic Astrophysics	3
	ASTR 4080	Intro to Cosmology	3
	ASTR 4090	Stellar Astrophysics	3
	ASTR 5560	Stars and Stellar Populations	3
	ASTR 5570	Galaxies	3
	ASTR 5580	Cosmology	3

Practical Physics Electives – Astronomy & Astrophysics

Select two courses from the list below:

	PHYS 3410	Found of Modern Optics	
	PHYS 3610	Electronics for Sci Instrument	3
	PHYS 3620	Data Aquisition for Sci Instrumentation	3
	PHYS 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4
	PHYS 3730	Intro to Computing in Physics	4
	PHYS 4060	Observational Astronomy	3

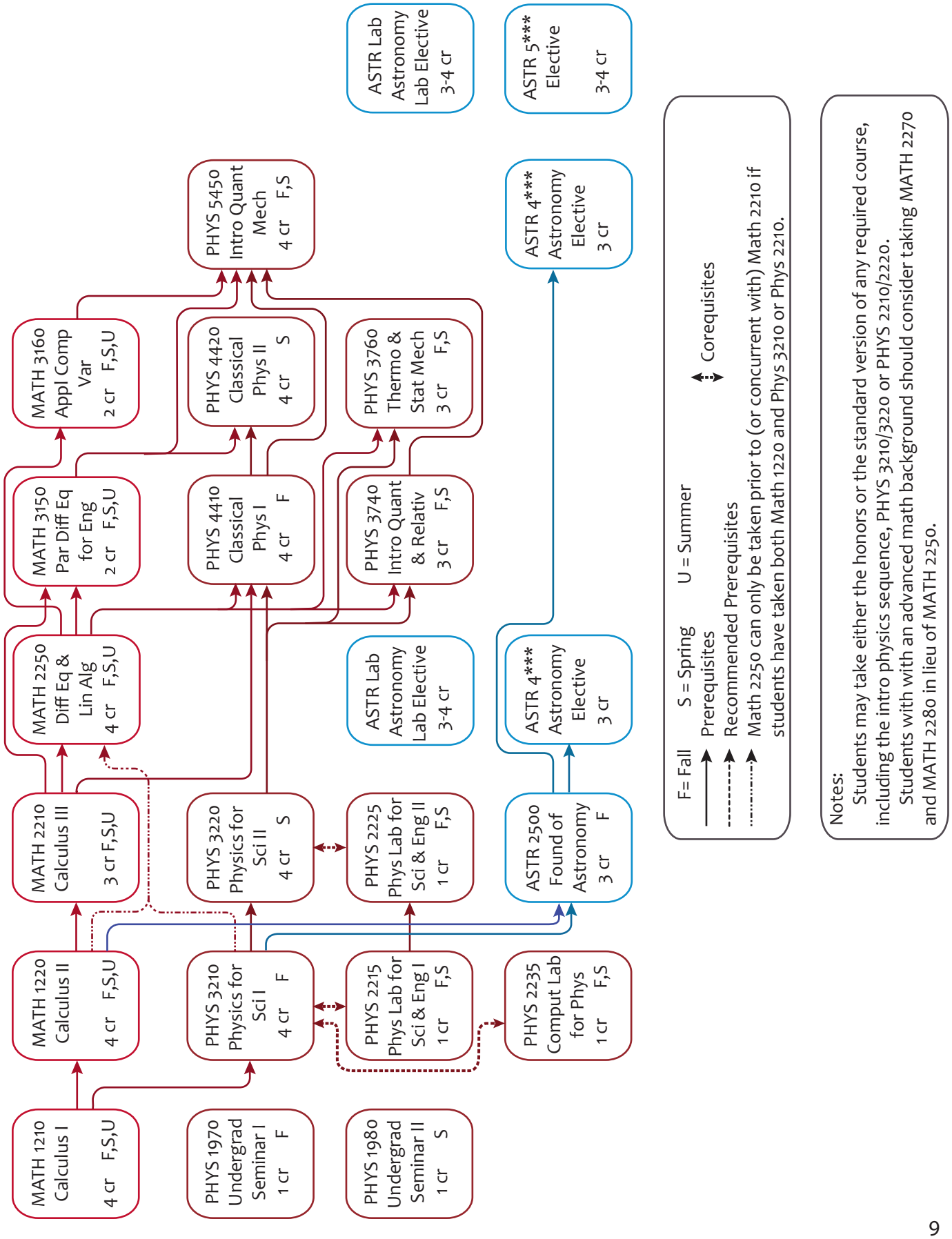
Advanced Physics Electives – Astronomy & Astrophysics

Select one PHYS/ASTR 5*** course:

	PHYS/ASTR 5***		

B.S./B.A.

PHYSICS MAJOR
ASTRONOMY & ASTROPHYSICS



Notes:

Students may take either the honors or the standard version of any required course, including the intro physics sequence, PHYS 3210/3220 or PHYS 2210/2220.

Students with with an advanced math background should consider taking MATH 2270 and MATH 2280 in lieu of MATH 2250.

PHYSICS MAJOR
BIOMEDICAL PHYSICS

B.S./B.A.

The Physics Bachelor's Degree with a Biomedical Physics emphasis was designed by a professor in the department who holds both a PhD in Physics and an MD. The degree is designed with the intent of allowing students to complete their premed requirements as well as complete a degree in physics. This is an ideal degree for applying to medical school. Students also use this degree program to prepare to study biophysics or medical physics. Students choose electives to best meet their goals and interests.

Core Physics Courses – Required for All Majors

	PHYS 1970	Undergrad Seminar I	1
	PHYS 1980	Undergrad Seminar II	1
	PHYS 2210/3210	Physics I for Scientists & Engineers/Physics I for Scientists	4
	PHYS 2215	Physics I Lab for Sci & Eng	1
	PHYS 2235	Comp Lab for Physicists	1
	PHYS 2220/3220	Physics II for Scientists & Eng/ Physics II for Scientists	4
	PHYS 2225	Physics II Lab for Sci & Eng	1
	PHYS 3740	Intro Quant Theory and Rel	3
	PHYS 3760	Thermo and Stat Mechanics	3

Core Math Courses – Biomedical Physics

	MATH 1210	Calculus I	4
	MATH 1220	Calculus II	4
	MATH 2210[1]	Calculus III	3
	MATH 2250[2]	Diff Eq and Lin Alg	4
	MATH 4600[3]	Mathematics in Physiology and Medicine	4

[1]Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.
[2]Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.
[3]Students may substitute MATH 3150-3160 for MATH 4600.

Chemistry Courses – Biomedical Physics

	CHEM 1210/1211	General Chemistry I/Honors General Chemistry I	4
	CHEM 1215/1240	Gen ChemLab I/Honors Gen Chem Lab I	1
	CHEM 1220/1221	General Chemistry II/Honors General Chemistry II	4
	CHEM 1225/1241	Gen ChemLab II/Honors Gen Chem Lab II	1
	CHEM 2310/2311	Organic Chem I/Honors Organic Chem I	4
	CHEM 2315	Organic Chem Lab I	2

See the undergraduate advisor about approval for additional courses.

Advanced Physics Courses – Biomedical Physics

	PHYS 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4
	PHYS 5010	Classical Mechanics and Quantum Mechanics	4
	PHYS 5020	Electricity and Magnetism and Quantum Mechanics	4

Additional Physics Electives – Biomedical Physics

Select one course from the advanced physics electives and one course from the practical physics electives:

	PHYS (adv)		
	PHYS (lab)		

Adv. Physics Electives: PHYS 4210: Optics in Bio, PHYS 4230: Moleculer Motors, PHYS 4310: Physics in Bio, PHYS 5110: Nuclear/Particle Phys, PHYS 5510: Solid State Phys I

Practical Physics Electives: PHYS 3330: Audio and Video, PHYS 3410: Modern Optics, PHYS 3610: Electronics, PHYS 3620: Data Aquisition, PHYS 3730: Computing in Physics, PHYS 5760: Physical Measure and Instrument

Allied Courses – Biomedical Physics

Select five credit hours from chemisty, three courses from biology and one biology lab course :

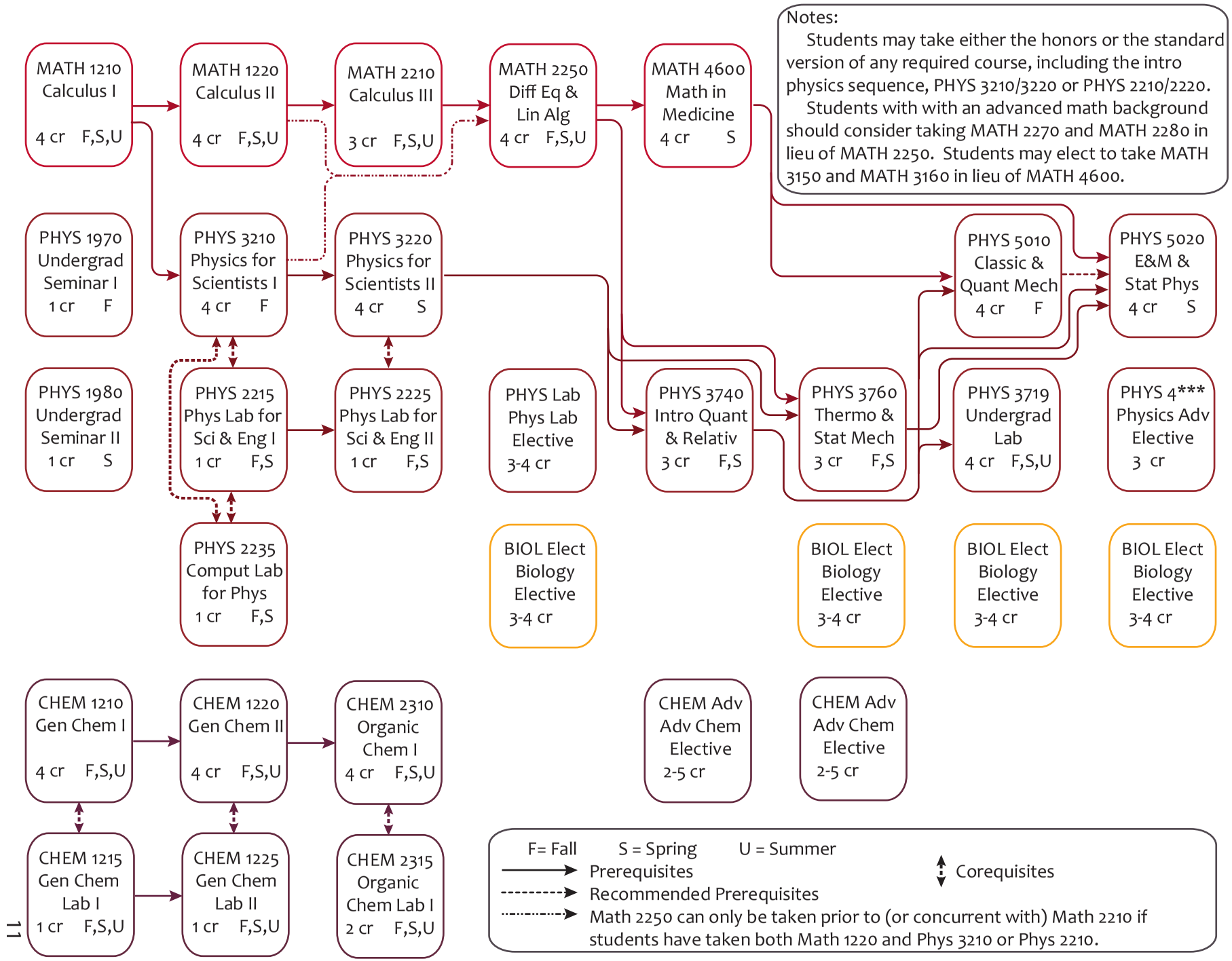
1.	CHEM		
2.	CHEM		
3.	CHEM		
1.	BIOL		
2.	BIOL		
3.	BIOL		
1.	BIOL (lab)		

Chemistry Electives: CHEM 2320: O Chem II, CHEM 2321: O Chem II Honors, CHEM 2325: O Chem II Lab, CHEM 3000: Quant Analysis, CHEM 3100: Inorganic Chem, CHEM 3130: Solid State Chem, CHEM 3200: Radio Chem, Chem 5810: Nanoscience

Biology Electives: BIOL 1610: Biology, BIOL 2020: Cell Bio, BIOL 2021: Cell Science, BIOL 2030: Genetics, BIOL 2420: Physiology, BIOL 3510: Bio Chem

Biology Lab Electives: BIOL 3215: Cell Bio Lab, BIOL 3515: BioChem Lab

PHYSICS MAJOR
BIOMEDICAL PHYSICS
B.S./B.A.



Notes:

Students may take either the honors or the standard version of any required course, including the intro physics sequence, PHYS 3210/3220 or PHYS 2210/2220.

Students with with an advanced math background should consider taking MATH 2270 and MATH 2280 in lieu of MATH 2250. Students may elect to take MATH 3150 and MATH 3160 in lieu of MATH 4600.

PHYSICS TEACHING MAJOR B.S./B.A.

The Physics Teaching Bachelor's Degree is intended for students who plan on becoming teachers in the secondary school system. It includes all the required courses for an endorsement in Physics through the Utah State Office of Education, a sampling of courses required for the licensure program through the Urban Institute for Teacher Education (UITE), as well as additional depth and breadth courses beneficial for physics teachers. Students in this degree program should also meet with the UITE advisors: Sara Southwick, sara.hatch@utah.edu or Karla Motta, karla.motta@utah.edu.

Core Physics Courses – Required for All Majors

	PHYS 1970	Undergrad Seminar I	1
	PHYS 1980	Undergrad Seminar II	1
	PHYS 2210/3210	Physics I for Scientists & Engineers/Physics I for Scientists	4
	PHYS 2215	Physics I Lab for Sci & Eng	1
	PHYS 2235	Comp Lab for Physicists	1
	PHYS 2220/3220	Physics II for Scientists & Eng/ Physics II for Scientists	4
	PHYS 2225	Physics II Lab for Sci & Eng	1
	PHYS 3740	Intro to Quantum Theory and Relativity	3
	PHYS 3760	Thermodyamics and Statistical Mechanics	3

Core Math Courses – Physics Teaching

	MATH 1210	Calculus I	4
	MATH 1220	Calculus II	4
	MATH 2210[1]	Calculus III	3
	MATH 2250[2]	Differential Equations and Linear Algebra	4

[1]Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.
[2]Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

Chemistry Courses – Physics Teaching

	CHEM 1210/1211	General Chemistry I/Honors General Chemistry I	4
	CHEM 1215/1240	Gen ChemLab I/Honors Gen Chem Lab I	1
	CHEM 1220/1221	General Chemistry II/Honors General Chemistry II	4
	CHEM 1225/1241	Gen ChemLab II/Honors Gen Chem Lab II	1

Advanced Physics Courses – Physics Teaching

	PHYS 3719/3729	Undergraduate Lab/Honors Undergraduate Lab	4

See the undergraduate advisor about approval for additional courses.

Additional Physics Electives – Physics Teaching

Select one course from the advanced physics electives, one course from the practical physics electives, and one 5*** level course:

	PHYS (adv)		
	PHYS (lab)		
	PHYS/ASTR 5***		

Adv. Physics Electives: Any PHYS/ASTR course numbered 3000 or up excluding PHYS 3111 and PHYS 3670.

Practical Physics Electives: PHYS 3330: Audio and Video, PHYS 3410: Modern Optics, PHYS 3610: Electronics, PHYS 3620: Data Aquisition, PHYS 3730: Computing in Physics, PHYS 5760: Physical Measure and Instrument, ASTR 4060: Observational Astronomy

Education Courses – Physics Teaching

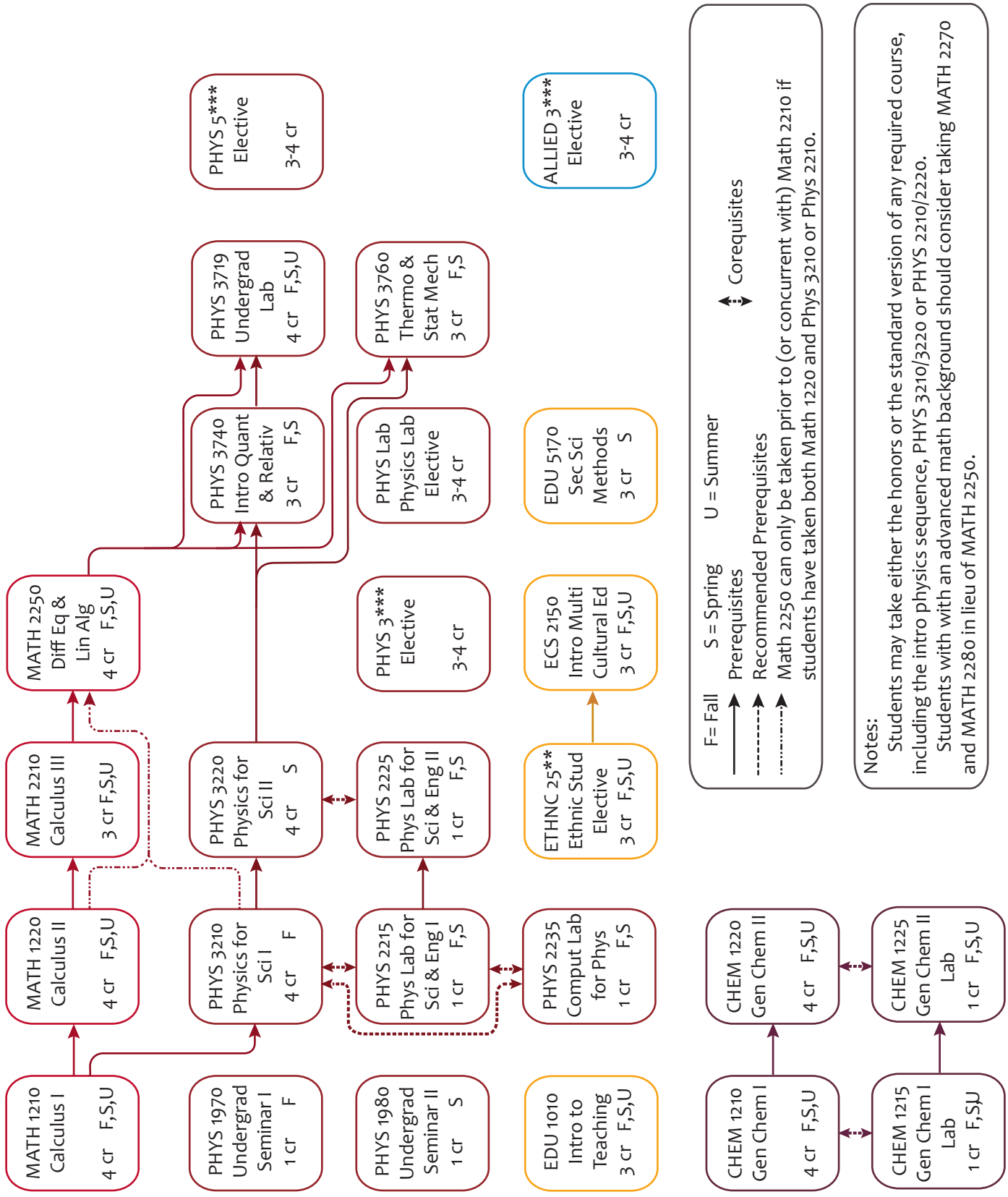
EDU 1010	Intro to Teaching	3
ETHNC 25**	Ethnic Studies Elective	3
ECS 2150	Intro to Multi Cultural Ed	3
EDU 5170/5375	Secondary Science Methods/ Science Methods	3

Allied Elective Courses – Physics Teaching

Select one course

Allied Electives: GEO 3250: Geology of Utah, CHEM 3000: Quant Analysis, CHEM 3060: Quant Chem and Spectro, CHEM 3090: Physical Chem for Life Sci, CHEM 3100: Inorganic Chem, MATH 3010: History of Math, MATH 3070: Applied Stats I, MATH 3100: Found of Geometry, MATH 3210: Found of Analysis I, MATH 4030: Found of Algebra, MATH 5750: Applied Math, CH EN 3353: Fluid Mechanics, CH EN 3453: Heat Transfer, CH EN 3553: Chem Reaction Eng, CH EN 3603: Mass Transfer, CVEEN 3210: Structural Loads, CVEEN 3310: Geotech Eng I, CVEEN 3410: Hydraulics, CVEEN 3510: Civ Eng Materials, CVEEN 3520: Transport Eng, MSE 3061: Transport Phenom in MSE, MSE 3210: Electronic Prop of Solids, MSE 3310: Ceramics, MSE 3410: Polymers

B.S./B.A. PHYSICS TEACHING MAJOR



HONORS DEGREE IN PHYSICS

Honors College Requirements

	2 Intellectual Traditions Courses	6
	1 Honors Writing Course	3
	1 Honors Science Course	3-4
	Honors Electives	9
	Honors Thesis (PHYS/ASTR 4999)	3

Department Requirements

In addition to the requirements for the physics degree, students seeking an Honors Degree must also meet the following requirements:

	B or better in all courses required for major	
	PHYS and ASTR GPA of at least 3.5	
	Overall GPA of at least 3.5	
	Complete 20 credit hours of approved honors course work within Physics & Astronomy and Allied classes.	

Honors Science/Elective Courses

Courses offered by the Department of Physics & Astronomy that fill Honors elective requirements are:

	PHYS 3210	Physics I for Scientists	4
	PHYS 3220	Physics II for Scientists	4
	PHYS 3729	Honors Undergraduate Lab	4
	PHYS 4410	Classical Physics I	4
	PHYS 4420	Classical Physics II	4
	PHYS 5450	Intro to Quantum Mechanics	4
	PHYS 5460	Quantum Mechanics and Statistical Mechanics	4
	PHYS 5510	Solid State Physics I	3
	PHYS 5520	Solid State Physics II	3
	ASTR/ PHYS 5560	Stars and Stellar Populations	3
	ASTR/ PHYS 5570	Galaxies	3
	ASTR/ PHYS 5580	Cosmology	3

ASTRONOMY MINOR

Required Prereq Courses – Astronomy Minor

	MATH 1210	Calculus I	4
	MATH 1220	Calculus II	4
	MATH 2210[1]	Calculus III	3
	PHYS 2210/3210	Physics I for Scientists & Engineers/Physics I for Scientists	4
	PHYS 2220/3220	Physics II for Scientists & Eng/ Physics II for Scientists	4

Required Course – Astronomy Minor

	ASTR 2500	Found of Astronomy	3

Elective Courses – Astronomy Minor

Select three courses from the list below:

	PHYS 4060	Observational Astronomy	3
	ASTR 4070	Extragalactic Astrophysics	3
	ASTR 4080	Intro to Cosmology	3
	ASTR 4090	Stellar Astrophysics	3
	ASTR 5560	Stars and Stellar Populations	3
	ASTR 5570	Galaxies	3
	ASTR 5580	Cosmology	3

PHYSICS MINOR

Intro Physics Courses – Physics Minor

Select up to ten credit hours from the list below:

	PHYS 2210/3210	Physics I for Scientists & Engineers/Physics I for Scientists	4
	PHYS 2215	Physics I Lab for Sci & Eng	1
	PHYS 2235	Comp Lab for Physicists	1
	PHYS 2220/3220	Physics II for Scientists & Eng/Physics II for Scientists	4
	PHYS 2225	Physics II Lab for Sci & Eng	1

Upper Division Courses – Physics Minor*

Select six or more credit hours of upper division approved coursework, totalling 16 credit hours:

1.	PHYS/ASTR		
2.	PHYS/ASTR		
3.	PHYS/ASTR		

*NOTE: To fulfill requirement, student must take any Physics or Astronomy course numbered 3000-5999, EXCEPT:

PHYS 3111, PHYS 3210, PHYS 3220, PHYS 3670, PHYS 3949, PHYS 3970, PHYS 4800, PHYS 4999

PHYSICS TEACHING MINOR

Intro Physics Courses – Physics Teaching Minor

	PHYS 2210/3210	Physics I for Scientists & Engineers/Physics I for Scientists	4
	PHYS 2215	Physics I Lab for Sci & Eng	1
	PHYS 2220/3220	Physics II for Scientists & Eng/ Physics II for Scientists	4
	PHYS 2225	Physics II Lab for Sci & Eng	1

Core Math Courses – Physics Teaching Minor

	MATH 1210	Calculus I	4
	MATH 1220	Calculus II	4
	MATH 2210[1]	Calculus III	3
	MATH 2250[2]	Differential Equations and Linear Algebra	4

[1]Qualified students are encouraged to substitute MATH 1250-1260 for MATH 1210-1220-2210.
[2]Qualified students are encouraged to substitute MATH 2270-2280 for MATH 2250.

Required Courses – Physics Teaching Minor

	PHYS 3740	Intro to Quantum Theory and Relativity	3
	EDU 5170/5375	Secondary Science Methods/ Science Methods	3

Elective Course – Physics Teaching Minor*

Select at least one course of upper division approved coursework:

1.		

*NOTE: To fulfill requirement, student must take any Physics or Astronomy course numbered 3000-5999, EXCEPT:

PHYS 3111, PHYS 3210, PHYS 3220, PHYS 3670, PHYS 3949, PHYS 3970, PHYS 4800, PHYS 4999