

# Physics, BS - Optics Concentration

Optics is a multidisciplinary field. Students completing the optics concentration receive exposure to geometrical optics, physical optics, optical instruments, interference and diffraction, polarimetry, optoelectronics, lasers, optical sources and detectors, and radiometry along with laboratory experience using state-of-the-art equipment and modern optical techniques.

## Physics, Optics Concentration, BS Requirements:

- All students are encouraged to see an advisor after completion of 24 credits.
- Physics, Optics Concentration, BS degree requires 128 credit hours.
- 39 of 128 credit hours must be taken at 300 level or higher (39 credits includes courses taken at the 300+ level in major, minor (if chosen), Pre-professional area and electives).
- 12 credit hours of 300 level and above must be taken in the major or 6 credit hours in the major and 6 credit hours in the minor (if chosen).
- 12 of the last 18 credit hours must be taken at UAH, with an overall 25% of coursework taken at UAH.
- Unless otherwise noted a C- or better is required for all College of Science prerequisite courses.
- No more than 64 credit hours from a two-year college can be applied toward a UAH degree.
- For graduation application instructions, see here (<http://catalog.uah.edu/undergrad/policies-procedures/application-graduation/>).

## Degree Requirements

Charger Foundations Requirements

\*Please see Area V for CoS requirements that can also be used to fulfill Charger Foundations Requirements.

| Code  | Title  | Semester Hours |
|---|--|----------------|
| <b>Area I: Freshman Composition</b>   |  | <b>3-6</b>     |
| EH 101<br>or EH 101S  | COLLEGE WRITING I<br>COLLEGE WRITING I W/STUDIO  |                |
| EH 102  | COLLEGE WRITING II   |                |
| EH 103  | ACCELERATED COLLEGE WRITING  |                |
| EH 105  | HONORS ENGLISH SEMINAR   |                |
| <b>Area II: Humanities and Fine Arts*</b>   |  | <b>12</b>      |
| Fine Arts   |  | <b>3</b>       |
| ARH 100   | ARH SURV:ANCIENT-MEDIEVAL  |                |
| ARH 101   | ARH SURV:RENAISSANCE-MODERN  |                |
| ARH 103   | ARH SUR: WORLD ART   |                |
| ARS 160   | DRAWING: FOUNDATIONS   |                |
| TH 122  | THEATRE APPRECIATION   |                |
| TH 123  | INTRO TO FILM STUDIES  |                |
| MU 100  | INTRO TO MUSIC LITERATURE  |                |
| Literature  |  | <b>3-6</b>     |
| EH 207  | READINGS LITERATURE/CULTURE I  |                |
| EH 208  | READINGS LITERATURE/CULTURE 2  |                |
| EH 209  | HONORS SEM READINGS LIT/CUL I  |                |
| EH 210  | HONORS SEM READINGS LIT/CUL 2  |                |
| EH 242  | MYTHOLOGY  |                |
| Humanities and Fine Arts  |  | <b>3-6</b>     |
| CM 113  | Intro to Rhetorical Communication  |                |
| WLC 101S<br>or WLC 101A<br>or WLC 101F<br>or WLC 101G<br>or WLC 101J<br>or WLC 101R | INTRO FOREIGN LANG I: SPANISH<br>INTRO FOREIGN LANG I: ARABIC<br>INTRO FOREIGN LANG I:FRENCH<br>INTRO FOREIGN LANG I:GERMAN<br>INTRO FOREIGN LANG I:JAPANESE<br>INTRO FOREIGN LANG I:RUSSIAN |                |
| WLC 102S<br>or WLC 102A   | INTRO FOREIGN LANG II:SPANISH<br>INTRO FOREIGN LANG II: ARABIC   |                |

|   |  |              |
|---|--|--------------|
| or WLC 102F                               | INTRO FOREIGN LANG II:FRENCH                       |              |
| or WLC 102G                               | INTRO FOREIGN LANG II:GERMAN                       |              |
| or WLC 102J                               | INTRO FOREIGN LANG II:JAPANESE                     |              |
| or WLC 102R                               | INTRO FOREIGN LANG II:RUSSIAN                      |              |
| WLC 201S                                  | INTERM FOREIGN LANG:SPANISH                        |              |
| or WLC 201A                               | INTERM FOREIGN LANG I: ARABIC                      |              |
| or WLC 201F                               | INTERM FOREIGN LANG:FRENCH                         |              |
| or WLC 201G                               | INTERM FOREIGN LANG:GERMAN                         |              |
| or WLC 201J                               | INTERM FOREIGN LANG: JAPANESE                      |              |
| or WLC 201R                               | INTERM FOREIGN LANG:RUSSIAN                        |              |
| WLC 202S                                  | INTERM FOREIGN LANG II:SPANISH                     |              |
| or WLC 202A                               | INTERM FOREIGN LANG II: ARABIC                     |              |
| or WLC 202F                               | INTERM FOREIGN LANG II:FRENCH                      |              |
| or WLC 202G                               | INTERM FOREIGN LANG II:GERMAN                      |              |
| or WLC 202J                               | INTERM FORGN LANG II:JAPANESE                      |              |
| or WLC 202R                               | INTERM FOREIGN LANG II:RUSSIAN                     |              |
| WLC 204                                   | INTERNATIONAL CINEMA                               |              |
| PHL 101                                   | INTRODUCTION TO PHILOSOPHY                         |              |
| PHL 102                                   | INTRO TO ETHICS                                    |              |
| PHL 103                                   | INTRODUCTION TO LOGIC                              |              |
| PHL 150                                   | TECH, SCIENCE & HUMAN VALUES                       |              |
| WGS 200                                   | INTRO WOMEN'S & GENDER STUDIES                     |              |
| AMS 229                                   | ANCIENT & MEDIEVAL WORLDS                          |              |
| ARH 100                                   | ARH SURV:ANCIENT-MEDIEVAL                          |              |
| ARH 101                                   | ARH SURV:RENAISSANCE-MODERN                        |              |
| ARH 103                                   | ARH SUR: WORLD ART                                 |              |
| ARS 160                                   | DRAWING: FOUNDATIONS                               |              |
| TH 122                                    | THEATRE APPRECIATION                               |              |
| TH 123                                    | INTRO TO FILM STUDIES                              |              |
| MU 100                                    | INTRO TO MUSIC LITERATURE                          |              |
| <b>Area III: Mathematics and Sciences</b> |  | <b>11-12</b> |
| Mathematics                               |  | 3-4          |
| MA 105                                    | NATURE OF MATHEMATICS                              |              |
| MA 107                                    | ALGEBRA WITH APPLICATIONS                          |              |
| MA 110                                    | FINITE MATHEMATICS                                 |              |
| MA 112                                    | PRECALCULUS ALGEBRA                                |              |
| MA 113                                    | PRECALCULUS TRIGONOMETRY                           |              |
| MA 115                                    | PRECALCULUS ALGEBRA & TRIG                         |              |
| MA 120                                    | MATH PROFESSIONAL APPLICATIONS                     |              |
| MA 171                                    | CALCULUS A   |              |
| Natural Sciences (Lab)                    |  | 8            |
| AST 100                                   | SURVEY OF ASTRONOMY                                |              |
| AST 106                                   | EXPLORING THE COSMOS I                             |              |
| AST 107                                   | EXPLORING THE COSMOS II                            |              |
| BYS 109                                   | FUNDAMENTALS OF BIOLOGY                            |              |
| BYS 119                                   | PRINCIPLES OF BIOLOGY                              |              |
| BYS 120                                   | ORGANISMAL BIOLOGY                                 |              |
| BYS 215                                   | HUMAN ANATOMY & PHYSIOLOGY I                       |              |
| CH 101<br>& CH 105                        | INTRO TO CHEMISTRY<br>and INTRO CHEMISTRY LAB      |              |
| CH 121<br>& CH 125                        | GENERAL CHEMISTRY I<br>and GENERAL CHEMISTRY LAB I |              |

|                    |   |
|--------------------|---|
| CH 123<br>& CH 126 | GENERAL CHEMISTRY II<br>and GENERAL CHEMISTRY LAB II      |
| CH 151<br>& CH 105 | GENERAL, ORGANIC, BIOCHEMISTRY<br>and INTRO CHEMISTRY LAB |
| ESS 103            | ENVIRONMENTAL EARTH SCIENCE                               |
| ESS 111            | WEATHER, CLIMATE & GLOBAL CHNG                            |
| PH 100             | CONCEPTUAL PHYSICS  |
| PH 101             | GENERAL PHYSICS I   |
| PH 102             | GENERAL PHYSICS II  |
| PH 111<br>& PH 114 | GEN PHYSICS W/CALCULUS I<br>and GENERAL PHYSICS LAB I     |
| PH 112<br>& PH 115 | GEN PHYSICS W/CALC II<br>and GENERAL PHYSICS LAB II       |
| PH 113<br>& PH 116 | GEN PHYSICS W/CALC III<br>and GENERAL PHYSICS LAB III     |

**Area IV: History and Social and Behavioral Sciences\*** **12**

History 3-6

|        |                          |
|--------|--------------------------|
| HY 103 | WORLD HISTORY TO 1500    |
| HY 104 | WORLD HISTORY SINCE 1500 |
| HY 221 | UNITED STATES TO 1877    |
| HY 222 | UNITED STATES SINCE 1877 |

Social and Behavioral Sciences 6-9

|         |   |
|---------|---|
| ECN 142 | PRINC OF MACROECONOMICS                 |
| ECN 143 | PRINC OF MICROECONOMICS                 |
| GS 200  | GLOBAL SYSTEMS AND CULTURES             |
| ESS 105 | WORLD REGIONAL GEOGRAPHY                |
| ESS 110 | PRINCIPLES OF HUMAN GEOGRAPHY           |
| PSC 101 | INTRO TO AMERICAN GOVERNMENT            |
| PSC 102 | INTRO TO COMPARATIVE POLITICS           |
| PSC 260 | INTRODUCTION TO INTERNATIONAL RELATIONS |
| PY 101  | GENERAL PSYCHOLOGY I                    |
| PY 201  | LIFE-SPAN DEVELOPMENT                   |
| SOC 100 | INTRO TO SOCIOLOGY                      |
| SOC 102 | ANALYSIS OF SOCIAL PROBLEMS             |
| SOC 103 | INTRO TO CRIMINOLOGY                    |
| SOC 105 |   |

\* Take either 1 EH (Area II) + 2 HY (Area IV) <OR> 2 EH (Area II) + 1 HY (Area IV). Take no more than six hours in a single discipline in Area II or Area IV.

Area V: Pre Professional Requirements

| Code   | Title  | Semester Hours |
|--|--|----------------|
| Courses in this area may also fulfill Charger Foundations requirements |  |                |
| <b>Communications</b>  |  | <b>3</b>       |
| CM 113   | Intro to Rhetorical Communication                    |                |
| <b>Chemistry sequence</b>  |  | <b>8</b>       |
| CH 121<br>& CH 125   | GENERAL CHEMISTRY I<br>and GENERAL CHEMISTRY LAB I   |                |
| CH 123<br>& CH 126   | GENERAL CHEMISTRY II<br>and GENERAL CHEMISTRY LAB II |                |
| <b>Mathematics</b> <sup>2</sup>  |  | <b>18</b>      |
| MA 171   | CALCULUS A   |                |
| MA 172   | CALCULUS B   |                |

|   |   |            |
|---|---|------------|
| MA 201  | CALCULUS C  |            |
| MA 238  | APPL DIFFERENTIAL EQUATIONS                               |            |
| MA 244  | INTRO TO LINEAR ALGEBRA                                   |            |
| <b>Computer Science</b>                                     |   | <b>3</b>   |
| CS 102<br>or CS 104   | INTRO TO C PROGRAMMING<br>INTRO TO CS USING PYTHON        |            |
| <b>Technical Writing</b>                                    |   | <b>3</b>   |
| EH 301  | TECHNICAL WRITING   |            |
| <b>Additional Science or Engineering course: Choose one</b> |   | <b>3-4</b> |
| AST 106<br>& 106L   | EXPLORING THE COSMOS I<br>and ASTRONOMY LABORATORY        |            |
| BYS 119<br>& 119L<br>& 119R                                 | PRINCIPLES OF BIOLOGY<br>and LABORATORY<br>and RECITATION |            |
| CH 101<br>& CH 105  | INTRO TO CHEMISTRY<br>and INTRO CHEMISTRY LAB             |            |
| CS 121  | COMPUTER SCIENCE I  |            |
| ESS 103<br>& 103L   | ENVIRONMENTAL EARTH SCIENCE<br>and LABORATORY             |            |
| ESS 111<br>& 111L   | WEATHER, CLIMATE & GLOBAL CHNG<br>and LABORATORY          |            |
| MA 112  | PRECALCULUS ALGEBRA                                       |            |
| MA 113  | PRECALCULUS TRIGONOMETRY                                  |            |
| MA 281  | ELEMENTS OF STATISTICAL ANALYS                            |            |
| Higher level math course                                    |   |            |
| Engineering course  |   |            |

## Major Requirements

| Code                                     | Title   | Semester Hours |
|--|---|----------------|
| <b>Physics Core</b>                      |   | <b>28</b>      |
| PH 110                                   | FRONTIERS IN SCIENCE                                  |                |
| PH 111<br>& PH 114                       | GEN PHYSICS W/CALCULUS I<br>and GENERAL PHYSICS LAB I |                |
| PH 112<br>& PH 115                       | GEN PHYSICS W/CALC II<br>and GENERAL PHYSICS LAB II   |                |
| PH 113<br>& PH 116                       | GEN PHYSICS W/CALC III<br>and GENERAL PHYSICS LAB III |                |
| PH 251                                   | SPECIAL RELATIVITY                                    |                |
| PH 301                                   | INTERMEDIATE MECHANICS                                |                |
| PH 305                                   | MATH METHODS IN PHYSICS                               |                |
| PH 351                                   | INTRODUCTION TO MODERN PHYSICS                        |                |
| PH 499                                   | PHYSICS PRACTICUM                                     |                |
| <b>Optics Concentration Requirements</b> |   | <b>15</b>      |
| OPT 341                                  | GEOMETRICAL OPTICS                                    |                |
| OPT 342                                  | PHYSICAL OPTICS                                       |                |
| OPT 411                                  | OPTICS LAB  |                |
| PH/OPT 300+ level or higher course       |   |                |
| PH/OPT 400+ level or higher course       |   |                |

## Elective Requirements

| Code | Title | Semester Hours |
|------|-------|----------------|
|------|-------|----------------|

**Elective Courses****19-20**

Additional Elective courses 100+ level to reach 128 credit hours. Electives can be taken from any department and do not have to be taken in your major or minor. No more than 4 credits of 100 level HPE courses can count toward degree requirements.

## Overall Requirements

| Code | Title | Semester Hours |
|------|-------|----------------|
|------|-------|----------------|

All College of Science degrees must have at least 128 credits.

At least 39 of the 128 credits must be at the 300+ level. These may be taken in any area including electives.

**Total Semester Hours****128**

- Students must take one literature and one history course. Students must also take either a second literature or history course to complete a sequence. Acceptable Literature sequences must include one early literature (EH 207 or EH 242 or EH 209) and one later literature (EH 208 or EH 210). Acceptable history sequences are (HY 103 + HY 104), or (HY 221 + HY 222)
- Based on Math placement, (<http://www.uah.edu/science/departments/math/undergraduate-students/placement/>) prerequisite MA 112 and/or MA 113 Mathematics courses may be required.
- No more than 6 credit hours can be taken in a single discipline.
- For choices see the World Languages and Cultures (<http://catalog.uah.edu/undergrad/colleges-departments/arts-humanities-social-sciences/foreign-languages-literatures/>) department.

**Sample Four-Year Plan for Physics, Optics Concentration, BS degree:**

**Note: This is only an example and variations are possible.**

**Year 1**

| Fall  |   | Semester Hours |
|---|---|----------------|
| FYE 101S  | CHARGER SUCCESS - SCIENCE                             | 1              |
| PH 110  | FRONTIERS IN SCIENCE                                  | 3              |
| CH 121<br>& CH 125  | GENERAL CHEMISTRY I<br>and GENERAL CHEMISTRY LAB I    | 4              |
| MA 171  | CALCULUS A  | 4              |
| EH 101  | COLLEGE WRITING I                                     | 3              |
| Term Semester Hours:  |   | 15             |
| <b>Spring</b>   |   |                |
| PH 111<br>& PH 114  | GEN PHYSICS W/CALCULUS I<br>and GENERAL PHYSICS LAB I | 4              |
| CH 123<br>& CH 126  | GENERAL CHEMISTRY II<br>and GENERAL CHEMISTRY LAB II  | 4              |
| MA 172  | CALCULUS B  | 4              |
| EH 102  | COLLEGE WRITING II                                    | 3              |
| Elective  |   | 2              |
| Electives can be taken from any department and do not have to be taken in your major or minor. No more than 4 credit hours of 100 level HPE courses can count toward degree requirements. |   |                |
| Term Semester Hours:  |   | 17             |

**Year 2**

| Fall                                    |   |   |
|---|---|---|
| PH 112<br>& PH 115                      | GEN PHYSICS W/CALC II<br>and GENERAL PHYSICS LAB II   | 4 |
| MA 201                                  | CALCULUS C  | 4 |
| CS 102<br>or CS 104                     | INTRO TO C PROGRAMMING<br>or INTRO TO CS USING PYTHON | 3 |
| Fine Art                                |   | 3 |
| See Requirements tab for approved list. |   |   |

|   |   |       |
|---|---|-------|
| Literature  |   | 3     |
| See Requirements tab for approved list.   |   |       |
| Term Semester Hours:  |   | 17    |
| <b>Spring</b>   |   |       |
| PH 113<br>& PH 116  | GEN PHYSICS W/CALC III<br>and GENERAL PHYSICS LAB III | 4     |
| PH 251  | SPECIAL RELATIVITY                                    | 1     |
| MA 238  | APPL DIFFERENTIAL EQUATIONS                           | 3     |
| CM 113  | Intro to Rhetorical Communication                     | 3     |
| Humanities, 2nd Fine Art or 2nd<br>Literature   |   | 3     |
| See Requirements tab for approved list.   |   |       |
| Elective  |   | 3     |
| Electives can be taken from any department and do not have to be taken<br>in your major or minor. No more than 4 credit hours of 100 level HPE<br>courses can count toward degree requirements. |   |       |
| Term Semester Hours:  |   | 17    |
| <b>Year 3</b>   |   |       |
| <b>Fall</b>   |   |       |
| PH 351  | INTRODUCTION TO MODERN<br>PHYSICS                     | 3     |
| OPT 341   | GEOMETRICAL OPTICS                                    | 3     |
| MA 244  | INTRO TO LINEAR ALGEBRA                               | 3     |
| Additional Science or Engineering<br>Course   |   | 3-4   |
| See Requirements tab for approved list.   |   |       |
| Social and Behavioral Science   |   | 3     |
| See Requirements tab for approved list.   |   |       |
| Term Semester Hours:  |   | 15-16 |
| <b>Spring</b>   |   |       |
| PH 301  | INTERMEDIATE MECHANICS                                | 3     |
| PH 305  | MATH METHODS IN PHYSICS                               | 3     |
| OPT 342   | PHYSICAL OPTICS                                       | 3     |
| Social and Behavioral science   |   | 3     |
| See Requirements tab for approved list.   |   |       |
| History   |   | 3     |
| See Requirements tab for approved list.   |   |       |
| Term Semester Hours:  |   | 15    |
| <b>Year 4</b>   |   |       |
| <b>Fall</b>   |   |       |
| OPT 411   | OPTICS LAB  | 3     |
| PH/OPT 300+ level or higher course  |   | 3     |
| EH 301  | TECHNICAL WRITING                                     | 3     |
| 2nd History or 3rd Social and<br>Behavioral science   |   | 3     |
| See Requirements tab for approved list.   |   |       |
| Elective 300+ level or higher   |   | 3     |
| Elective  |   | 1     |
| Electives can be taken from any department and do not have to be taken<br>in your major or minor. No more than 4 credit hours of 100 level HPE<br>courses can count toward degree requirements. |   |       |
| Term Semester Hours:  |   | 16    |
| <b>Spring</b>   |   |       |

|                                      |                   |   |
|--------------------------------------|-------------------|---|
| PH 499                               | PHYSICS PRACTICUM | 3 |
| PH/OPT 400+ level or higher course   |                   | 3 |
| Elective 300+ level or higher course |                   | 3 |
| Elective 300+ level or higher course |                   | 3 |
| Elective                             |                   | 3 |
| Elective                             |                   | 1 |

Electives can be taken from any department and do not have to be taken in your major or minor. No more than 4 credit hours of 100 level HPE courses can count toward degree requirements.

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|                      |    |
|----------------------|----|
| Term Semester Hours: | 16 |
|----------------------|----|

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|                       |         |
|-----------------------|---------|
| Total Semester Hours: | 128-129 |
|-----------------------|---------|