

# B.S. IN OPTICAL SCIENCES & ENGINEERING

## CATALOG YEAR 2019-2020

Below is the *advised sequence* of courses for this degree program and prerequisites as of 12/18/18.

The official degree requirements and prerequisites found in the University General Catalog and the prerequisites are subject to change.

### OPTICS TRACK

| COURSE NUMBER AND TITLE  | UNITS | PREREQUISITES  |
|--|-------|--|
| <b>1<sup>ST</sup> SEMESTER</b>                                       |       |  |
| MATH 122A/B or MATH 125 Calculus I with Applications                 | 5/3   | Appropriate Math Placement   |
| CHEM 151 General Chemistry I or CHEM 161/163                         | 4     | Appropriate Math Placement   |
| ENGL 101 or 107 or 109H First-Year Composition                       | 3     |  |
| ENGR 102A/B Introduction to Engineering or ENGR 102                  | 3     | ENGR102A: MATH 113 or 120R & CHEM 151; Concurrent enrollment or completion of MATH 122B or 125 |
| Tier I General Education   | 3     |  |
| <b>2<sup>ND</sup> SEMESTER</b>                                       |       |  |
| MATH 129 Calculus II   | 3     | MATH 122B or 125 with C or better  |
| MSE 110 Solid State Chemistry  | 4     | CHEM 151 or 161/163  |
| PHYS 141 Introductory Mechanics or PHYS 161H                         | 4     | MATH 122B or 125 or appropriate Math Placement Level   |
| ENGL 102 or 108 First-Year Composition                               | 3     | ENGL 101 or ENGL 107   |
| Tier I General Education   | 3     |  |
| <b>3<sup>RD</sup> SEMESTER</b>                                       |       |  |
| OPTI 201R Geometrical & Instrumental Optics I (Fall Only)            | 3     | MATH 122B or 125, 129, PHYS 141 or 161H, MSE 110   |
| OPTI 201L Geometrical & Instrumental Optics Lab I (Fall Only)        | 1     | Concurrent enrollment or completion of OPTI 201R   |
| MATH 223 Vector Calculus   | 4     | MATH 129 with a C or better  |
| PHYS 241 Introductory Electricity and Magnetism or PHYS 261H         | 4     | For PHYS 241 or 261H: PHYS 141 or 161H; MATH 129 or appropriate Math Placement Level           |
| Technical Elective - See advisor for course approval                 | 3     |  |
| Tier I General Education   | 3     |  |
| <b>4<sup>TH</sup> SEMESTER</b>                                       |       |  |
| OPTI 202R Geometrical and Instrumental Optics II (Spring Only)       | 3     | OPTI 201R  |
| OPTI 202L Geometrical and Instrumental Optics Lab II (Spring Only)   | 1     | OPTI 201R; Concurrent enrollment or completion of OPTI 202R                                    |
| OPTI 280 Computer Programming (Spring Only)                          | 1     | Major: OSE   |
| OPTI 210 Physics Optics I (Spring Only)                              | 3     | Major: OSE; MATH 223, PHYS 241, Concurrent enrollment or completion of MATH 254, OPTI 280      |
| MATH 254 Intro to Ordinary Differential Equations                    | 3     | MATH 129 or 223 with C or better   |
| Tier 1 General Education   | 3     |  |
| ECE 207 Elements of Electrical Engineering or ECE 220 Basic Circuits | 3/5   | ECE 207: PHYS 241 or 261H; ECE 220: MATH 129 and PHYS 241 or 261H                              |

\*Grade of 'C' or better is required for all OSE curriculum except General Education classes.

# OPTICS TRACK

## COURSE NUMBER AND TITLE

## UNITS

**CURRENT PREREQUISITES FOR UPPER DIVISION COURSES CAN BE FOUND IN THE UA GENERAL CATALOG**

**ADVANCED STANDING IS REQUIRED FOR 3XX AND 4XX COURSES (SEE ADVISOR FOR REQUIREMENTS)**

### 5<sup>TH</sup> SEMESTER

|  |   |
|--|---|
| OPTI 341 Semiconductor Physics & Lasers (Fall Only)        | 3 |
| OPTI 380A Intermediate Optics Laboratory I (Fall Only)     | 1 |
| MATH 322 Mathematical Analysis for Engineers               | 3 |
| Technical Elective - See major advisor for course approval | 3 |
| OPTI 306 Radiometry, Sources and Detectors (Fall Only)     | 3 |
| Tier II General Education                                  | 3 |

### 6<sup>TH</sup> SEMESTER

|  |   |
|--|---|
| OPTI 330 Physical Optics II (Spring Only)                  | 3 |
| OPTI 340 Optical Design (Spring Only)                      | 3 |
| OPTI 370 Laser and Photonics (Spring Only)                 | 3 |
| OPTI 380B Intermediate Optics Laboratory II (Spring Only)  | 1 |
| Technical Elective – See major advisor for course approval | 3 |
| Tier II General Education                                  | 3 |

### 7<sup>TH</sup> SEMESTER

|   |   |
|---|---|
| ENGR 498A Cross-disciplinary Design (Fall Only) – Senior Status | 3 |
| Technical Elective – See major advisor for course approval      | 3 |
| OPTI 430 Optical Communication Systems (Fall Only)              | 3 |
| OPTI 421 Introductory Optomechanical Engineering (Fall Only)    | 3 |
| OPTI 471A Advanced Optics Laboratory (Fall Only)                | 2 |

### 8<sup>TH</sup> SEMESTER

|  |   |
|--|---|
| ENGR 498B Cross-disciplinary Design (Spring Only) – Senior Status      | 3 |
| OPTI 415 Optical Specifications, Fabrication and Testing (Spring Only) | 3 |
| OPTI 471B Advanced Optics Laboratory (Spring Only)                     | 2 |
| Technical Elective - See major advisor for course approval             | 3 |
| Technical Elective - See major advisor for course approval             | 3 |

\*Grade of 'C' or better is required for all OSE curriculum except General Education classes.

\*\*Tier I and II General Education Courses must meet University general education requirements. One course must be recognized by the university as meeting the Diversity Requirement.

# OPTO-MATERIALS TRACK

| COURSE NUMBER AND TITLE  | UNITS | PREREQUISITES  |
|--|-------|--|
| <b>1<sup>ST</sup> SEMESTER</b>                                     |       |  |
| MATH 122A/B or MATH 125 Calculus I with Applications               | 5/3   | Appropriate Math Placement   |
| CHEM 151 General Chemistry I or CHEM 161/163                       | 4     | Appropriate Math Placement   |
| ENGL 101 or 107 or 109H First-Year Composition                     | 3     |  |
| ENGR 102A/B Introduction to Engineering or ENGR 102                | 3     | ENGR102A: MATH 113 or 120R & CHEM 151; Concurrent enrollment or completion of MATH 122B or 125 |
| Tier I General Education   | 3     |  |
| <b>2<sup>ND</sup> SEMESTER</b>                                     |       |  |
| MATH 129 Calculus II   | 3     | MATH 122B or 125 with C or better  |
| MSE 110 Solid State Chemistry                                      | 4     | CHEM 151 or 161/163  |
| PHYS 141 Introductory Mechanics or PHYS 161H                       | 4     | MATH 122B or 125   |
| ENGL 102 or 108 First-Year Composition                             | 3     | ENGL 101 or ENGL 107   |
| Tier I General Education   | 3     |  |
| <b>3<sup>RD</sup> SEMESTER</b>                                     |       |  |
| OPTI 201R Geometrical & Instrumental Optics I (Fall Only)          | 3     | MATH 122B or 125, 129, PHYS 141 or 161H, MSE 110   |
| OPTI 201L Geometrical & Instrumental Optics Lab I (Fall Only)      | 1     | Concurrent enrollment or completion of OPTI 201R   |
| MATH 223 Vector Calculus   | 4     | MATH 129 with a C or better  |
| PHYS 241 Introductory Electricity and Magnetism or PHYS 261H       | 4     | For PHYS 241 or 261H: PHYS 141 or 161H; MATH 129 or appropriate Math Placement Level           |
| Tier I General Education   | 3     |  |
| <b>4<sup>TH</sup> SEMESTER</b>                                     |       |  |
| OPTI 202R Geometrical and Instrumental Optics II (Spring Only)     | 3     | OPTI 201R  |
| OPTI 202L Geometrical and Instrumental Optics Lab II (Spring Only) | 1     | OPTI 201R; Concurrent enrollment or completion of OPTI 202R                                    |
| OPTI 280 Computer Programming (Spring Only)                        | 1     | Major: OSE   |
| OPTI 210 Physics Optics I (Spring Only)                            | 3     | Major: OSE; MATH 223, PHYS 241, Concurrent enrollment or completion of MATH 254, OPTI 280      |
| MATH 254 Intro to Ordinary Differential Equations                  | 3     | MATH 129 or 223 with C or better   |
| MSE 345 Thermodynamics (Spring Only)                               | 4     | MATH 129, CHEM 151, MSE 110 or CHEM 152 or Department consent                                  |
| Tier I General Education   | 3     |  |

\*Grade of 'C' or better is required for all OSE curriculum except General Education classes.

# OPTO-MATERIALS TRACK

## COURSE NUMBER AND TITLE

## UNITS

**CURRENT PREREQUISITES FOR UPPER DIVISION COURSES CAN BE FOUND IN THE UA GENERAL CATALOG**

**ADVANCED STANDING IS REQUIRED FOR 3XX AND 4XX COURSES (SEE ADVISOR FOR REQUIREMENTS)**

### 5<sup>TH</sup> SEMESTER

|   |     |
|---|-----|
| OPTI 341 Semiconductor Physics & Lasers (Fall Only)                     | 3   |
| OPTI 380A Intermediate Optics Laboratory I (Fall Only)                  | 1   |
| MATH 322 Mathematical Analysis for Engineers                            | 3   |
| ECE 207 Elements of Electrical Engineering or<br>ECE 220 Basic Circuits | 3/5 |
| MSE 365 Physical Properties of Materials (Fall Only)                    | 3   |
| OPTI 306 Radiometry, Sources and Detectors (Fall Only)                  | 3   |

### 6<sup>TH</sup> SEMESTER

|   |   |
|---|---|
| OPTI 330 Physical Optics II (Spring Only)                 | 3 |
| OPTI 340 Optical Design (Spring Only)                     | 3 |
| OPTI 370 Laser and Photonics (Spring Only)                | 3 |
| OPTI 380B Intermediate Optics Laboratory II (Spring Only) | 1 |
| MSE Elective– See major advisor for course approval       | 3 |
| Tier II General Education                                 | 3 |

### 7<sup>TH</sup> SEMESTER

|  |   |
|--|---|
| ENGR 498A Cross-disciplinary Design (Fall Only) – Senior Status    | 3 |
| MSE 434 Electrical and Optical Properties of Materials (Fall only) | 3 |
| OPTI 430 Optical Communication Systems (Fall Only)                 | 3 |
| OPTI 421 Introductory Optomechanical Engineering (Fall Only)       | 3 |
| OPTI 471A Advanced Optics Laboratory (Fall Only)                   | 2 |
| MSE Technical Elective – See major advisor for course approval     | 2 |

### 8<sup>TH</sup> SEMESTER

|  |   |
|--|---|
| ENGR 498B Cross-disciplinary Design (Spring Only) – Senior Status              | 3 |
| OPTI 415 Optical Specifications, Fabrication, and Testing (Spring Only)        | 3 |
| OPTI 471B Advanced Optics Laboratory (Spring Only)                             | 2 |
| MSE 480 Advanced Characterization Methods in<br>Material Science & Engineering | 3 |
| Tier II General Education  | 3 |

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# OPTO-ELECTRONICS TRACK

| COURSE NUMBER AND TITLE  | UNITS | PREREQUISITES  |
|--|-------|--|
| <b>1<sup>ST</sup> SEMESTER</b>                                     |       |  |
| MATH 122A/B or MATH 125 Calculus I with Applications               | 5/3   | Appropriate Math Placement   |
| CHEM 151 General Chemistry I or CHEM 161/163                       | 4     | Appropriate Math Placement   |
| ENGL 101 or 107 or 109H First-Year Composition                     | 3     |  |
| ENGR 102A/B Introduction to Engineering or ENGR 102                | 3     | ENGR102A: MATH 113 or 120R & CHEM 151; Concurrent enrollment or completion of MATH 122B or 125 |
| Tier I General Education   | 3     |  |
| <b>2<sup>ND</sup> SEMESTER</b>                                     |       |  |
| MATH 129 Calculus II   | 3     | MATH 122B or 125 with C or better  |
| MSE 110 Solid State Chemistry                                      | 4     | CHEM 151 or 161/163  |
| PHYS 141 Introductory Mechanics or PHYS 161H                       | 4     | MATH 122B or 125   |
| ENGL 102 or 108 First-Year Composition                             | 3     | ENGL 101 or ENGL 107   |
| Tier I General Education   | 3     |  |
| <b>3<sup>RD</sup> SEMESTER</b>                                     |       |  |
| OPTI 201R Geometrical & Instrumental Optics I (Fall Only)          | 3     | MATH 122B or 125, 129, PHYS 141 or 161H, MSE 110   |
| OPTI 201L Geometrical & Instrumental Optics Lab I (Fall Only)      | 1     | Concurrent enrollment or completion of OPTI 201R   |
| MATH 223 Vector Calculus   | 4     | MATH 129 with a C or better  |
| PHYS 241 Introductory Electricity and Magnetism or PHYS 261H       | 4     | For PHYS 241 or 261H: PHYS 141 or 161H; MATH 129 or appropriate Math Placement Level           |
| ECE 175 Computer Programming for Engineering Applications          | 3     | Concurrent enrollment or completion of MATH 122B or 125  |
| <b>4<sup>TH</sup> SEMESTER</b>                                     |       |  |
| OPTI 202R Geometrical and Instrumental Optics II (Spring Only)     | 3     | OPTI 201R  |
| OPTI 202L Geometrical and Instrumental Optics Lab II (Spring Only) | 1     | Concurrent enrollment or completion of in OPTI 202R  |
| OPTI 280 Computer Programming (Spring Only)                        | 1     | Major: OSE   |
| OPTI 210 Physics Optics I (Spring Only)                            | 3     | Major: OSE; MATH 223, PHYS 241, Concurrent enrollment or completion of MATH 254, OPTI 280      |
| MATH 254 Intro to Ordinary Differential Equations                  | 3     | MATH 129 or 223 with C or better   |
| ECE 220 Basic Circuits   | 5     | MATH 129 and PHYS 241 or 261H  |

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# OPTO-ELECTRONICS TRACK

## COURSE NUMBER AND TITLE

## UNITS

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**ADVANCED STANDING IS REQUIRED FOR 3XX AND 4XX COURSES (SEE ADVISOR FOR REQUIREMENTS)**

### 5<sup>TH</sup> SEMESTER

|   |   |
|---|---|
| OPTI 341 Semiconductor Physics & Lasers (Fall Only) | 3 |
|---|---|

|  |   |
|--|---|
| OPTI 380A Intermediate Optics Laboratory I (Fall Only) | 1 |
|--|---|

|  |   |
|--|---|
| MATH 322 Mathematical Analysis for Engineers | 3 |
|--|---|

|                        |   |
|------------------------|---|
| ECE 274A Digital Logic | 4 |
|------------------------|---|

|  |   |
|--|---|
| OPTI 306 Radiometry, Sources and Detectors (Fall Only) | 3 |
|--|---|

|                          |   |
|--------------------------|---|
| Tier I General Education | 3 |
|--------------------------|---|

### 6<sup>TH</sup> SEMESTER

|   |   |
|---|---|
| OPTI 330 Physical Optics II (Spring Only) | 3 |
|---|---|

|                                       |   |
|---------------------------------------|---|
| OPTI 340 Optical Design (Spring Only) | 3 |
|---------------------------------------|---|

|  |   |
|--|---|
| OPTI 370 Laser and Photonics (Spring Only) | 3 |
|--|---|

|   |   |
|---|---|
| OPTI 380B Intermediate Optics Laboratory II (Spring Only) | 1 |
|---|---|

|  |   |
|--|---|
| ECE 381A Introductory Electromagnetics | 4 |
|--|---|

|                           |   |
|---------------------------|---|
| Tier II General Education | 3 |
|---------------------------|---|

### 7<sup>TH</sup> SEMESTER

|   |   |
|---|---|
| ENGR 498A Cross-disciplinary Design (Fall Only) – Senior Status | 3 |
|---|---|

|                          |   |
|--------------------------|---|
| Tier I General Education | 3 |
|--------------------------|---|

|  |   |
|--|---|
| OPTI 430 Optical Communication Systems (Fall Only) | 3 |
|--|---|

|  |   |
|--|---|
| OPTI 421 Introductory Optomechanical Engineering (Fall Only) | 3 |
|--|---|

|  |   |
|--|---|
| OPTI 471A Advanced Optics Laboratory (Fall Only) | 2 |
|--|---|

|  |   |
|--|---|
| ECE Technical Elective – See major advisor for course approval | 2 |
|--|---|

### 8<sup>TH</sup> SEMESTER

|   |   |
|---|---|
| ENGR 498B Cross-disciplinary Design (Spring Only) – Senior Status | 3 |
|---|---|

|   |   |
|---|---|
| OPTI 415 Optical Specifications, Fabrication, and Testing (Spring Only) | 3 |
|---|---|

|  |   |
|--|---|
| OPTI 471B Advanced Optics Laboratory (Spring Only) | 2 |
|--|---|

|  |   |
|--|---|
| ECE Technical Elective - See major advisor for course approval | 3 |
|--|---|

|                           |   |
|---------------------------|---|
| Tier II General Education | 3 |
|---------------------------|---|

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# OPTO-MECHANICS TRACK

| COURSE NUMBER AND TITLE  | UNITS | PREREQUISITES  |
|--|-------|--|
| <b>1<sup>ST</sup> SEMESTER</b>                                     |       |  |
| MATH 122A/B or MATH 125 Calculus I with Applications               | 5/3   | Appropriate Math Placement   |
| CHEM 151 General Chemistry I or CHEM 161/163                       | 4     | Appropriate Math Placement   |
| ENGL 101 or 107 or 109H First-Year Composition                     | 3     |  |
| ENGR 102A/B Introduction to Engineering or ENGR 102                | 3     | ENGR102A: MATH 113 or 120R & CHEM 151; Concurrent enrollment or completion of MATH 122B or 125 |
| Tier I General Education   | 3     |  |
| <b>2<sup>ND</sup> SEMESTER</b>                                     |       |  |
| MATH 129 Calculus II   | 3     | MATH 122B or 125 with C or better  |
| MSE 110 Solid State Chemistry                                      | 4     | CHEM 151 or 161/163  |
| PHYS 141 Introductory Mechanics or PHYS 161H                       | 4     | MATH 122B or 125 or appropriate Math Placement Level   |
| ENGL 102 or 108 First-Year Composition                             | 3     | ENGL 101 or ENGL 107   |
| Tier I General Education   | 3     |  |
| <b>3<sup>RD</sup> SEMESTER</b>                                     |       |  |
| OPTI 201R Geometrical & Instrumental Optics I (Fall Only)          | 3     | MATH 122B or 125, 129, PHYS 141 or 161H, MSE 110   |
| OPTI 201L Geometrical & Instrumental Optics Lab I (Fall Only)      | 1     | Concurrent enrollment or completion of OPTI 201R   |
| MATH 223 Vector Calculus   | 4     | MATH 129 with a C or better  |
| PHYS 241 Introductory Electricity and Magnetism or PHYS 261H       | 4     | For PHYS 241 or 261H: PHYS 141 or 161H; MATH 129 or appropriate Math Placement Level           |
| CE 214 Statics   | 3     | PHYS 141 or 161H; MATH 129   |
| Tier I General Education   | 3     |  |
| <b>4<sup>TH</sup> SEMESTER</b>                                     |       |  |
| OPTI 202R Geometrical and Instrumental Optics II (Spring Only)     | 3     | OPTI 201R  |
| OPTI 202L Geometrical and Instrumental Optics Lab II (Spring Only) | 1     | Concurrent enrollment or completion of in OPTI 202R  |
| OPTI 280 Computer Programming (Spring Only)                        | 1     | Major: OSE   |
| OPTI 210 Physics Optics I (Spring Only)                            | 3     | Major: OSE; MATH 223, PHYS 241, Concurrent enrollment or completion of MATH 254, OPTI 280      |
| MATH 254 Intro to Ordinary Differential Equations                  | 3     | MATH 129 or 223 with C or better   |
| AME 250 Dynamics   | 3     | CE 214; Concurrent enrollment or completion of MATH 254  |
| Tier I General Education   | 3     |  |

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# OPTO-MECHANICS TRACK

## COURSE NUMBER AND TITLE

## UNITS

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### 5<sup>TH</sup> SEMESTER

|   |     |
|---|-----|
| OPTI 341 Semiconductor Physics & Lasers (Fall Only)                     | 3   |
| OPTI 380A Intermediate Optics Laboratory I (Fall Only)                  | 1   |
| MATH 322 Mathematical Analysis for Engineers                            | 3   |
| ECE 207 Elements of Electrical Engineering or<br>ECE 220 Basic Circuits | 3/5 |
| AME 324A Mechanical Behavior of Engineering Materials                   | 3   |
| OPTI 306 Radiometry, Sources and Detectors (Fall Only)                  | 3   |

### 6<sup>TH</sup> SEMESTER

|   |   |
|---|---|
| OPTI 330 Physical Optics II (Spring Only)                 | 3 |
| OPTI 340 Optical Design (Spring Only)                     | 3 |
| OPTI 370 Laser and Photonics (Spring Only)                | 3 |
| OPTI 380B Intermediate Optics Laboratory II (Spring Only) | 1 |
| AME 324B Engineering Component Design                     | 3 |
| Tier II General Education                                 | 3 |

### 7<sup>TH</sup> SEMESTER

|   |   |
|---|---|
| ENGR 498A Cross-disciplinary Design (Fall Only) – Senior Status | 3 |
| OPTI 430 Optical Communication Systems (Fall Only)              | 3 |
| OPTI 421 Introductory Optomechanical Engineering (Fall Only)    | 3 |
| OPTI 471A Advanced Optics Laboratory (Fall Only)                | 2 |
| AME Technical Elective- See major advisor for course approval   | 3 |

### 8<sup>TH</sup> SEMESTER

|   |   |
|---|---|
| ENGR 498B Cross-disciplinary Design (Spring Only) – Senior Status       | 3 |
| OPTI 415 Optical Specifications, Fabrication, and Testing (Spring Only) | 3 |
| OPTI 471B Advanced Optics Laboratory (Spring Only)                      | 2 |
| AME Technical Elective – See major advisor for course approval          | 3 |
| Tier II General Education   | 3 |

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