NDSU NORTH DAKOTA STATE UNIVERSITY

# COLLEGE OF SCIENCE & MATHEMATICS
# MAJOR: PHYSICS (Standard) & PHYSICS with Optical Science and Engineering Option
# ACADEMIC YEAR: 2013-2014
# DEGREE TYPE: B.A. or B.S.
# REQUIRED DEGREE CREDITS TO GRADUATE: 122

## GENERAL EDUCATION REQUIREMENTS – 40 CREDITS

**Lower Division Requirements – 37 Credits**

First Year Experience (F) - 1 Credit

| | | | |
|---|---|---|---|
| UNIV | 189 | Skills for Academic Success | 1 cr |

Students transferring in 24 or more credits do not need to take UNIV 189.

Communication (C) - 9 Credits

| | | | |
|---|---|---|---|
| ENGL | 110 | College Composition I | 3 cr |
| ENGL | 120 | College Composition II | 3 cr |
| COMM | 110 | Fund of Public Speaking | 3 cr |

Quantitative Reasoning (R) - 3 Credits

| | | | |
|---|---|---|---|
| MATH | 165 | Calculus I | 4 cr |

Science & Technology (S) - 10 Credits

| | | | |
|---|---|---|---|
| PHYS | 251/L | University Physics I/Lab | 4/1 cr |
| PHYS | 252/L | University Physics II/Lab | 4/1 cr |

Humanities & Fine Arts (A) - 6 Credits

Select from current general education courses www.ndsu.edu/registrar/gened/

Social & Behavioral Sciences (B) - 6 Credits

Select from current general education courses www.ndsu.edu/registrar/gened/

Wellness (W) - 2 Credits

Select from current general education courses www.ndsu.edu/registrar/gened/

Cultural Diversity (D)

Select from current general education courses www.ndsu.edu/registrar/gened/

Global Perspectives (G)

Select from current general education courses www.ndsu.edu/registrar/gened/

**Upper Division Requirements - Writing – 3 Credits**

Select from current general education courses www.ndsu.edu/registrar/gened/

## PHYSICS STANDARD MAJOR REQUIREMENTS – 40-42 CREDITS

- A grade of 'C' or better is required for all PHYS and AST prefix courses

| | | | |
|---|---|---|---|
| PHYS | 171 | Introductory Projects in Physics | 1 cr |
| PHYS | 251R | Univ. Physics I Recitation | 1 cr |
| PHYS | 252R | Univ. Physics II Recitation | 1 cr |
| PHYS | 350 | Modern Physics | 3 cr |
| PHYS | 360 | Modern Physics II | 3 cr |
| PHYS | 361or | Electromagnetic Theory | 3 or 4 cr |
| | 370 | Electromagnetic Theory (MSUM) | |
| PHYS | 370 | Introduction to Computational Physics | 3 cr |
| PHYS | 411/L | Optics for Scientists & Engineers/Lab | 3/1 cr |
| PHYS | 455 or | Classical Mechanics | 3 or 4 cr |
| | 330 | Intermediate Mechanics (MSUM) | |
| PHYS | 462 | Heat & Thermodynamics | 3 cr |
| PHYS | 485 | Quantum Mechanics I | 3 cr |
| PHYS | 486 | Quantum Mechanics II | 3 cr |
| PHYS | 489 | Sr. Project/Capstone | 3 cr |

**Physics Electives – 6 Credits – Select two courses from the following:**

| | | | |
|---|---|---|---|
| PHYS | 215 | Research for Undergraduates | 3 cr |
| PHYS | 413 | Lasers for Scientists & Engineers | 3 cr |
| PHYS | 415 | Elements of Photonics | 3 cr |
| PHYS | 463 | Statistical Mechanics | 3 cr |
| PHYS | 481 | Intro to Solid State Physics | 3 cr |

OR

MSUM AST courses with departmental permission.

## RELATED REQUIRED COURSES – 34-36 CREDITS

**Math – 19-20 Credits**

| | | | |
|---|---|---|---|
| MATH | 129 or | Basic Linear Algebra | 2 or 3 cr |
| | 429 | Linear Algebra | |
| MATH | 166 | Calculus II | 4 cr |
| MATH | 265 | Calculus III | 4 cr |
| MATH | 266 | Intro to Differential Equations | 3 cr |
| MATH | Electives | 400 Level (488 & 489 are recommended) | 6 cr |

**Chemistry – 8 Credits** (150/151 sequence recommended)

| | | | |
|---|---|---|---|
| CHEM | 150/160 or | Principles of Chemistry I/Lab | 3/1 cr |
| | 121/L | General Chemistry I/Lab | |
| CHEM | 151/161 or | Principles of Chemistry II/Lab | 3/1 cr |
| | 122/L | General Chemistry II/Lab | |

**Computer Science – 7-8 Credits**

| | | | |
|---|---|---|---|
| CSCI | 160 or | Computer Science I | 4 or 3 cr |
| ECE | 173 | Introduction to Computing | |
| CSCI | 161 | Computer Science II | 4 cr |

## COLLEGE REQUIREMENTS (Page 2) – 6 OR 12 CREDITS

## DEGREE REQUIREMENTS – UP TO 1 CREDIT TO REACH 122

**Degree requirements continued on page two.**

## PHYSICS - OPTICAL SCIENCE & ENGINEERING OPTION – 47-50 CREDITS

- A grade of 'C' or better is required for all PHYS and AST prefix courses

| | | | |
|---|---|---|---|
| PHYS | 171 | Introductory Projects in Physics | 1 cr |
| PHYS | 251R | University Physics I Recitation | 1 cr |
| PHYS | 252R | University Physics II Recitation | 1 cr |
| PHYS | 350 | Modern Physics | 3 cr |
| PHYS | 360 | Modern Physics II | 3 cr |
| PHYS | 361 or | Electromagnetic Theory | 3 or 4 cr |
| | 370 | Electromagnetic Theory (MSUM) | |
| PHYS | 370 | Intro to Computational Physics | 3 cr |
| PHYS | 411/L | Optics for Scientists & Engineers/Lab | 3/1 cr |
| PHYS | 413 | Lasers for Scientists & Engineers | 3 cr |
| PHYS | 415 | Elements of Photonics | 3 cr |
| PHYS | 455 or | Classical Mechanics | 3 or 4 cr |
| | 330 | Intermediate Mechanics (MSUM) | |
| PHYS | 462 | Heat & Thermodynamics | 3 cr |
| PHYS | 485 | Quantum Mechanics I | 3 cr |
| PHYS | 486 | Quantum Mechanics II | 3 cr |
| PHYS | 489 | Sr. Project/Capstone | 3 cr |
| CSCI | 160 or | Computer Science I | 4 or 3 cr |
| ECE | 173 | Introduction to Computing | |
| EE | 206 | Circuit Analysis I | 4 cr |

## RELATED REQUIRED COURSES – 27-28 CREDITS

**Math – 19-20 Credits**

| | | | |
|---|---|---|---|
| MATH | 166 | Calculus II | 4 cr |
| MATH | 265 | Calculus III | 4 cr |
| MATH | 266 | Intro to Differential Equations | 3 cr |
| MATH | 129 or | Basic Linear Algebra | 2 or 3 cr |
| | 429 | Linear Algebra | |
| MATH | Electives | 400 Level (452, 481 or 488 recommended) | 6 cr |

**Chemistry – 8 Credits** (150/151 sequence recommended)

| | | | |
|---|---|---|---|
| CHEM | 150/160 or | Principles of Chemistry I/Lab | 3/1 cr |
| | 121/L | General Chemistry I/Lab | |
| CHEM | 151/161 or | Principles of Chemistry II/Lab | 3/1 cr |
| | 122/L | General Chemistry II/Lab | |

## COLLEGE REQUIREMENTS – 6 OR 12 CREDITS

## DEGREE REQUIREMENTS – UP TO 1 CREDIT TO REACH 122

**Recommended Electives for Optical Science and Engineering Option**

| | | | |
|---|---|---|---|
| ECE | 311 | Circuit Analysis II | 4 cr |
| ECE | 417 | Optical Signal Transmission | 3 cr |
| ECE | 321 | Electronics I | 5 cr |
| ECE | 483 | Instrumentation for Engineers | 3 cr |

## COLLEGE REQUIREMENTS & DEGREE NOTES:

- Except for courses offered only as pass/fail grading, no course may be taken Pass/Fail.

**Bachelor of Science (BS) Degree –** An additional 6 credits in Humanities or Social Sciences*

**Bachelor of Arts (BA) Degree –** An additional 12 credits Humanities and Social Sciences* and proficiency at the second year level in a modern foreign language.

*Humanities and Social Sciences may be fulfilled by any course having the following prefix: ADHM, ANTH, ARCH, ART, CJ, CLAS, COMM, ECON, ENGL, FREN, GEOG, GERM, HDFS, HIST, LA, LANG, MUSC, PHIL, POLS, PSYC, RELS, SOC, SPAN, THEA, WGS, or any course from the approved list of general education courses in humanities and social sciences (general education categories A and B). These credits must come from outside the department of the student's major.