**Purdue Northwest Curriculum Document Coversheet**

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| --- | --- | --- | --- |
| **Document No:**(According to [Instruction](http://faculty.pnw.edu/blog/curriculum-document-approval-procedures/)s[[1]](#footnote-1)) | CES 18-05 REV CONCEN COMPUTATIONAL PHYSICS | **Approval by Faculty Senate:** (Leave Blank) | 12/14/18 |
| **Proposed Effective Date**  | Spring 2019 | **Date Reviewed by Senate Curriculum****Committee:** (Leave blank) | 11/9/18 |
| **Submitting Department:**(Name of both Dept & College/School ) | Chemistry & Physics DepartmentCollege of Engineering and Sciences | **Name(s) of Library Staff Consulted:** (NA if not required) |  |
| **Date Reviewed by Department**  | September 21, 2018 |  |  |
| **Submission Date:**(Date sent to College/School Curr Comm after Dept Review) |  | **Will New Library****Resources Used?** | [ ]  **Yes**[x]  **No** Double-click to check Yes / No. |
| **Date Reviewed by College/School Curriculum Committee**  |  | **Form 40 Needed?**(Double-click one box.)Registrar will complete Form 40 **after** Senate approval of document. | [ ]  **Yes** New courses or any course change, check **YES**[x]  **No** For **all other** curriculum matters, check **NO**. |
| **Contact Person(s):**(Name & Title) | Purna Das, Department Head  |  |  |

Unless marked “Leave blank” all parts of this form must be filled in **before** sending to Secretary of the Faculty Senate.

|  |
| --- |
| **Task (check all that apply and fill out sections appropriate for each change).** [x]  Program/Concentration Change or New Program/Concentration Proposal: Complete Section I, III, & IV[ ]  Minor Change or New Minor Proposal: Complete Section I (delete sections III & IV)[ ]  Certificate Change or New Certificate Proposal: Complete Section I (delete sections III & IV)[ ]  Course Change or New Course Proposal: Complete Section II (delete sections III & IV) |
| **Program name**. Physics – Computational Physics Concentration |
| **Degree name(s).** (If applicable.) Bachelor of Science |

## Section I: This section is for changes in programs, minors and certificates

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| --- |
| **List the major changes in each program of study, minor or certificate.** Physics – Computational Physics Concentration plan of study changes to Physics Electives. Physics Electives are corrected to reflect the inclusion of Physics and Astronomy courses.  |
| **Impact on Students.** (State “N/A” if proposal will not greatly affect students.) Students will be able to choose the correct prescribed electives. |
| **Impact on University Resources.** (State “N/A” if proposal will not require new resources, faculty or funds.)N/A |
| **Impact on other Academic Units.** (State “N/A” if proposal will not affect other units.)(Include name of person in affected area discussed with)N/A |

## Section II: This section is for changes in courses only

|  |
| --- |
| **Subject.** (Brief description of proposed change, addition or deletion.) |
| **Justification.** (Briefly list main reasons for proposed change, addition or deletion.) |

Use the **Current** and **Proposed** spaces below for course changes only. Otherwise, mark “N/A”

|  |  |
| --- | --- |
| **Current:** (Course changes: include entire present catalog information. Leave blank if new course)N/A | **Proposed:** (Course changes: include entire new catalog information.)N/A |
| **Is this course also:** | [ ]  **General Education** | **Currently Designated ExL (see** [**instructions[[2]](#footnote-2)**](http://faculty.pnw.edu/blog/curriculum-document-approval-procedures/)**)** [ ]  |

|  |
| --- |
| **Course Objectives / Learning Outcomes.** (New courses only. List main outcomes. If lengthy, attach separate page.)1. 2.3. |
| **Impact on Students.** (State “N/A” if proposal will not greatly affect students.)N/A |
| **Impact on University Resources.** (State “N/A” if proposal will not require new resources, faculty or funds.)N/A |
| **Impact on other Academic Units.** (State “N/A” if proposal will not affect other units.) (Include name of person in affected area this was discussed with.)N/A |

(Boxes will expand and spill over onto next page to accommodate your typing.)

 ***Document No:***

## Section III: PLAN OF STUDY REVISION

### Degree Name: Physics, BS, Concentration: Computational Physics

### Degree Requirements

* 120 Credit Hours
* Minimum grade of C- required for all College of Engineering and Sciences courses
* Minimum GPA of 2.0 required for graduation
* Certain courses may only be available at one campus location

### PNW General Education Core

| **Core Categories** | **Credits** | **Courses:** Enter “Select from list” or designate course(s) from list |
| --- | --- | --- |
| English Composition  | 6 | Select two courses from the English Composition Core list  |
| Speech Communication | 3 | Select from the Speech Communication Core list  |
| Quantitative Reasoning  | 5 | MA 16300 - Integrated Calculus Analysis Geometry I  |
| Natural Sciences  | 8 | PHYS 15200 - Mechanics and CHM 11500 - General Chemistry  |
| Technology | 3 | CS 12300 - Programming I: Java |
| Humanities | 3 | Select from the Humanities Core list  |
| Social Sciences | 3 | Select from the Social Sciences Core list  |
| Additional credits | 3 |  |
| General Ed Elective |  |  |
| First-Year Experience (FYE) | 1 | PHYS 19400 - Freshman Physics Orientation  |
| **Total** (minimum)  | **32** |  |

### Other Required Courses

Physics Electives 9 Credits

Any three (3) Physics or Astronomy courses 30000 level or higher.

Free Electives 4 credits

Total Other Required Courses **13 credits**

### Core: Required Courses

CHM 11600 - General Chemistry 4 credits

CS 12400 - Programming II: C++ 3 credits

MA 16400 - Integrated Calculus Analysis Geometry II 5 credits

MA 26100 - Multivariate Calculus 4 credits

MA 26400 - Differential Equations 3 credits

MA 26500 - Linear Algebra 3 credits

PHYS 25100 - Heat, Electricity And Optics 5 credits

PHYS 29400 - Sophomore Physics Seminar 1 credit

PHYS 31000 - Intermediate Mechanics 4 credits

PHYS 31100 - Quantum Physics I 3 credits

PHYS 33000 - Intermediate Electricity And Magnetism 3 credits

PHYS 34200 - Modern Physics 3 credits

PHYS 34300 - Modern Physics Laboratory 1 credit

PHYS 38000 - Advanced Physics Laboratory 3 credits

PHYS 40200 - Senior Research I 2 credits

PHYS 40300 - Senior Research II 3 credits

PHYS 41800 - Thermal And Statistical Physics 3 credits

PHYS 49400 - Junior-Senior Physics Seminar 1 credit

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 Total **54 credits**

### Concentration

CS 27500 - Data Structures 3 credits

CS 33200 - Algorithms 3 credits

MA 37700 - Computational Mathematics I 3 credits

MA 37800 - Computational Mathematics II 3 credits

MSV 56700 - Simulation Techniques 3 credits

PHYS 30800 - Scientific Computation 3 credits

PHYS 30900 - Scientific Computation II 3 credits

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Total Concentration **21 credits**

**Total credits required for baccalaureate degree: \_120\_\_\***

**\***For degree programs that require an excess of 120 credit hours, provide explanation and attach documentation, if appropriate.

## Section IV: For all Program Changes;

## Current Semester by Semester

(Delete if new program)

**Requirements**

**Minimum Grade and Grade Point Average (GPA):**  Minimum grade of C- required for all College of Engineering and Sciences courses; 2.0 GPA

**Experiential Learning (EL):**  One EL course required.  EL courses are noted by (e) next to the course title.

**Milestone Courses noted by (m) next to the course title have been identified as being critical to your success in this field of study.**

Courses that are only offered on one campus will be noted by an **(H)** for Hammond, or **(W)** for Westville.

Please see the Additional Information and Guidelines section below for more information.

**Semester One Total Credits = 16**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Integrated Calculus Analysis Geometry I | MA 16300 | X | 5 | C- | MA 15900 or MA 15400 or ALEKS Placement 085 |
| General Chemistry I | CHM 11500 | X | 4 | C- | MA 15300 |
| Freshman Physics Orientation - **Fall Only** | PHYS 19400  | X | 1 |  |  |
| English Composition 1 | Any Gen Ed English Composition course | X | 3 |  |  |
| Speech Communications | Any Gen Ed Speech Communication course | X | 3 |  |  |

**Semester Two Total Credits = 16**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Mechanics | PHYS 15200 | X | 4 | C- | MA 16300 |
| General Chemistry II | CHM 11600 |  | 4 | C- | CHM 11500 |
| Integrated Calculus Analysis Geometry II **(m)** | MA 16400 **(m)** |  | 5 | C- | MA 16300 |
| English Composition 2 | Any Gen Ed English Composition course | X | 3 |  |  |

**Semester Three Total Credits = 16**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Heat, Electricity And Optics **(m)** | PHYS 25100 **(m)** |  | 5 | C- | PHYS 15200 and MA 16400 |
| Multivariate Calculus | MA 26100 |  | 4 | C- | MA 16400 |
| Programming I: Java - **(H)** **Fall Only** | CS 12300  |  | 3 | C- | MA 15900 or MA 16300 |
| Linear Algebra | MA 26500 |  | 3 | C- | MA 16400 |

**Semester Four Total Credits = 14**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Sophomore Physics Seminar - **(H) Spring Only** | PHYS 29400  |  | 1 | C- | PHYS 25100 |
| Modern Physics - **(H) Spring Only** | PHYS 34200  |  | 3 | C- | PHYS 25100 or PHYS 26100 |
| Modern Physics Lab - **(H) Spring Only** | PHYS 34300  |  | 1 | C- | Co-requisite: PHYS 34200 |
| Differential Equations | MA 26400 |  | 3 | C- | MA 26100 |
| Programming II: C++ - **(H) Spring Only** | CS 12400  |  | 3 | C- | CS 12300 |
| Humanities Elective | Any Gen Ed Humanities course | X | 3 |  |  |

**Semester Five Total Credits = 15**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Quantum Physics 1 - **(H) Fall Only (odd years)** | PHYS 31100  |  | 3 | C- | MA 26400 and PHYS 34200 |
| Intermediate Electricity and Magnetism - **(H) Fall Only** | PHYS 33000  |  | 3 | C- | (PHYS 25100 or PHYS 26100) and MA 26400 |
| Scientific Computation - **(H) Fall Only (odd years)** | PHYS 30800  |  | 3 | C- | PHYS 25100 or PHYS 26100 |
| Data Structures - **(H) Fall Only** | CS 27500  |  | 3 | C- | CS 12400 |
| Computational Mathematics I - **(H) Fall Only (odd years)** | MA 37700  |  | 3 | C- | MA 26500 |

**Semester Six Total Credits = 14**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Junior/Senior Physics Seminar - **(H) Spring Only** | PHYS 49400  |  | 1 | C- | PHYS 29400 and PHYS 33000 |
| Scientific Computation II - **(H) Spring Only (even years)** | PHYS 30900  |  | 3 | C- | PHYS 30800  |
| Computational Mathematics II - **(H) Spring Only (even years)** | MA 37800  |  | 3 | C- | MA 37700 or MA 26400 |
| Physics Elective - **(H)** | Any PHYS course 30000 level or higher  |  | 3 | C- |  |
| Social Sciences Elective | Any Gen Ed Social Science course | X | 3 |  |  |
| Free Elective | Any Free Elective |  | 1 |  |  |

**Semester Seven Total Credits = 15**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Intermediate Mechanics - **(H) Fall Only (even years)** | PHYS 31000  |  | 4 | C- | PHYS 25100 and MA 26400 |
| Senior Research I **(e)** - **Fall Only** | PHYS 40200 **(e)**  |  | 2 | C- |  |
| Algorithms - **(H) Fall Only (even years)** | CS 33200  |  | 3 | C- | CS 27500  |
| Physics Elective | Any PHYS course 30000 level or higher |  | 3 | C- |  |
| Free Elective | Any Free Elective |  | 3 |  |  |

**Semester Eight Total Credits = 15**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Advanced Physics Lab - **(H) Spring Only (odd years)** | PHYS 38000  |  | 3 | C- | PHYS 31000 and PHYS 34200 and PHYS 343 and PHYS 33000 |
| Senior Research II **(e)** - **Spring Only** | PHYS 40300 **(e)**  |  | 3 | C- | PHYS 40200 |
| Thermal And Statistical Physics - **(H) Spring Only (odd years)**  | PHYS 41800  |  | 3 | C- | PHYS 31000 |
| Simulation Techniques - **(H) Spring Only (odd years)** | MSV 56700  |  | 3 | C- |  |
| Physics Elective | Any PHYS course 30000 level or higher |  | 3 | C- |  |

Notes:

***Additional Information and Guidelines***

Upper division physics courses are offered on a two year rotation. Contact an advisor to determine the specific semester a particular course will be offered.  Certain courses may only be available at one campus location.

Any individual course within CES must be a C- or better, but the average GPA for all disciplinary courses (CHM, CS or PHYS courses) must be at least 2.50.

## Section IV continued: For all Program Changes;

## Proposed Semester by Semester

**Requirements**

**Minimum Grade and Grade Point Average (GPA):**  Minimum grade of C- required for all College of Engineering and Sciences courses; 2.0 GPA

**Experiential Learning (EL):**  One EL course required.  EL courses are noted by (e) next to the course title.

**Milestone Courses noted by (m) next to the course title have been identified as being critical to your success in this field of study.**

Courses that are only offered on one campus will be noted by an **(H)** for Hammond, or **(W)** for Westville.

Please see the Additional Information and Guidelines section below for more information.

**Semester One Total Credits = 16**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Integrated Calculus Analysis Geometry I | MA 16300 | X | 5 | C- | MA 15900 or MA 15400 or ALEKS Placement 085 |
| General Chemistry I | CHM 11500 | X | 4 | C- | MA 15300 |
| Freshman Physics Orientation - **Fall Only** | PHYS 19400  | X | 1 |  |  |
| English Composition 1 | Any Gen Ed English Composition course | X | 3 |  |  |
| Speech Communications | Any Gen Ed Speech Communication course | X | 3 |  |  |

**Semester Two Total Credits = 16**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Mechanics | PHYS 15200 | X | 4 | C- | MA 16300 |
| General Chemistry II | CHM 11600 |  | 4 | C- | CHM 11500 |
| Integrated Calculus Analysis Geometry II **(m)** | MA 16400 **(m)** |  | 5 | C- | MA 16300 |
| English Composition 2 | Any Gen Ed English Composition course | X | 3 |  |  |

**Semester Three Total Credits = 16**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Heat, Electricity And Optics **(m)** | PHYS 25100 **(m)** |  | 5 | C- | PHYS 15200 and MA 16400 |
| Multivariate Calculus | MA 26100 |  | 4 | C- | MA 16400 |
| Programming I: Java | CS 12300  |  | 3 | C- | MA 15900 or MA 16300 |
| Linear Algebra | MA 26500 |  | 3 | C- | MA 16400 |

**Semester Four Total Credits = 14**

| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
| Sophomore Physics Seminar - **(H) Spring Only** | PHYS 29400  |  | 1 | C- | PHYS 25100 |
| Modern Physics - **(H) Spring Only** | PHYS 34200  |  | 3 | C- | PHYS 25100 or PHYS 26100 |
| Modern Physics Lab - **(H) Spring Only** | PHYS 34300  |  | 1 | C- | Co-requisite: PHYS 34200 |
| Differential Equations | MA 26400 |  | 3 | C- | MA 26100 |
| Programming II: C++ | CS 12400  |  | 3 | C- | CS 12300 |
| Humanities Elective | Any Gen Ed Humanities course | X | 3 |  |  |

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| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
| --- | --- | --- | --- | --- | --- |
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| Intermediate Electricity and Magnetism - **(H) Fall Only** | PHYS 33000  |  | 3 | C- | (PHYS 25100 or PHYS 26100) and MA 26400 |
| Scientific Computation - **(H) Fall Only (odd years)** | PHYS 30800  |  | 3 | C- | PHYS 25100 or PHYS 26100 |
| Data Structures - **(H) Fall Only** | CS 27500  |  | 3 | C- | CS 12400 |
| Computational Mathematics I - **(H) Fall Only (odd years)** | MA 37700  |  | 3 | C- | MA 26500 |

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| Junior/Senior Physics Seminar - **(H) Spring Only** | PHYS 49400  |  | 1 | C- | PHYS 29400 and PHYS 33000 |
| Scientific Computation II - **(H) Spring Only (even years)**  | PHYS 30900 (Also allowed ECE 15200, CIS 26300, or CIS 26600) |  | 3 | C- | PHYS 30800  |
| Computational Mathematics II - **(H) Spring Only (even years)** | MA 37800  |  | 3 | C- | MA 37700 or MA 26400 |
| Physics Elective - **(H)** | Any PHYS or ASTR course 30000 level or higher  |  | 3 | C- |  |
| Social Sciences Elective | Any Gen Ed Social Science course | X | 3 |  |  |
| Free Elective | Any Free Elective |  | 1 |  |  |

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| Algorithms - **(H) Fall Only (even years)** | CS 33200  |  | 3 | C- | CS 27500  |
| Physics Elective | Any PHYS or ASTR course 30000 level or higher |  | 3 | C- |  |
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| **Program Requirements : Designate Program Requirement** | **Subject Code/Course Number** | **(GenEd)****Yes=X** | **Credits****Number** | **Min Grade** | **Prerequisites** |
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| Senior Research II **(e)** - **Spring Only** | PHYS 40300 **(e)**  |  | 3 | C- | PHYS 40200 |
| Thermal And Statistical Physics - **(H) Spring Only (odd years)** | PHYS 41800  |  | 3 | C- | PHYS 31000 |
| Simulation Techniques - **(H) Spring Only (odd years)** | MSV 56700  |  | 3 | C- |  |
| Physics Elective | Any PHYS or ASTR course 30000 level or higher |  | 3 | C- |  |

Notes:

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1. <http://faculty.pnw.edu/blog/curriculum-document-approval-procedures/> [↑](#footnote-ref-1)
2. <http://faculty.pnw.edu/blog/curriculum-document-approval-procedures/> [↑](#footnote-ref-2)