**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 18-08 REV CONCEN NUCLEAR SCIENCE | **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 Department  College 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** **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**  **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).**  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 - Nuclear Science 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.**  Modification of Physics Electives in the Nuclear Science Concentration plan of study to reflect the inclusion of Physics and Astronomy courses. Additionally, the nuclear courses offered under PHYS 47000 number (Special Topics in Physics) have now received new numbers. Hence the current revision shows the new numbers for those courses (Nuclear Power, Nuclear Physics and Neutron Physics). Alternative courses for certain other courses (ENGR 15100 and CS 12400) in the program have been specified for clarity and accessibility. |
| **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: Nuclear Science

### 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 | ENGR 15100 - Software Tools For Engineers,CS 12300 - Programming I: Java, or CIS 16600 - Introduction To Programming |
| 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 3 Credits

Any Physics or Astronomy course 30000 level or higher.

Free Electives 4 credits

Total Other Required Courses **7 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

ECE 20100 - Linear Circuit Analysis I 3 credits

ECE 20700 - Electronic Measurement Techniques 1 credit

ME 30500 - General Thermodynamics I 3 credits

ME 31200 - Fluid Mechanics 3 credits

ME 31300 - Fluid Mechanics Laboratory 1 credit

ME 41600 - Heat Transfer 3 credits

ME 41700 - Heat Transfer Laboratory 1 credit

PHYS 30800 - Scientific Computation 3 credits

PHYS 34700 - Nuclear Power 3 credits

PHYS 34800 - Nuclear Physics 3 credits

PHYS 44900 - Neutron Physics 3 credits

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Total Concentration **27 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 |
| Linear Circuit Analysis I - **Fall Only** | ECE 20100 |  | 3 | C- | Co-requisite: ECE 20700, MA 26100, and PHYS 26100 |
| Electronic Measurement Techniques - **Fall Only** | ECE 20700 |  | 1 | C- | Co-requisite: ECE 20100 |
| Humanities Elective | Any Gen Ed approved Humanities course | X | 3 |  |  |

**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 - **Spring Only** | PHYS 34200 |  | 3 | C- | PHYS 25100 or PHYS 26100 |
| Modern Physics Lab - **Spring Only** | PHYS 34300 |  | 1 | C- | Co-requisite: PHYS 34200 |
| Differential Equations | MA 26400 |  | 3 | C- | MA 26100 |
| Social Sciences Elective | Any Gen Ed Social Science | X | 3 |  |  |
| General Thermodynamics I - **Spring Only** | ME 30500 |  | 3 | C- | MA 26100 and PHYS 26100 |

**Semester Five Total Credits = 16**

| **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 |
| Fluid Mechanics - **Fall Only** | ME 31200 |  | 3 | C- |  |
| Software Tools for Engineers | ENGR 15100, CIS 12300, or CIS 16600 | X | 3 | C- | MA 15900 or MA 15400 or ALEKS Placement 085 |
| Fluid Mechanics Laboratory - **Fall Only** | ME 31300 |  | 1 | C- |  |

**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 |
| Special Topics in Physics - **(H) Spring Only (even years)** | PHYS 47000 |  | 3 | C- |  |
| Programming II: C++ - **Spring Only** | CS 12400 |  | 3 | C- | CS 12300 |
| Linear Algebra | MA 26500 |  | 3 | C- | MA 16400 |
| Physics Elective | Any PHYS course 30000 level or higher |  | 3 | C- |  |
| Free Elective | Any Free Elective |  | 1 |  |  |

**Semester Seven Total Credits = 12**

| **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)** | PHYS 40200 **(e)** |  | 2 | C- |  |
| Special Topics in Physics - **(H)** | PHYS 47000 |  | 3 | C- |  |
| Free Elective | Any Free Elective |  | 3 |  |  |

**Semester Eight Total Credits = 16**

| **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 |
| Heat Transfer - **Spring Only** | ME 41600 |  | 3 | C- | ME 30500 and ME 31200 and ME 313 |
| Heat Transfer Laboratory - **Spring Only** | ME 41700 |  | 1 | C- | ME 31300 |
| Special Topics in Physics - **(H)** | PHYS 47000 |  | 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, ECE, ENGR, ME 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 |
| Linear Circuit Analysis I - **Fall Only** | ECE 20100 |  | 3 | C- | Co-requisite: ECE 20700, MA 26100, and PHYS 26100 |
| Electronic Measurement Techniques - **Fall Only** | ECE 20700 |  | 1 | C- | Co-requisite: ECE 20100 |
| Humanities Elective | Any Gen Ed approved Humanities course | X | 3 |  |  |

**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 - **Spring Only** | PHYS 34200 |  | 3 | C- | PHYS 25100 or PHYS 26100 |
| Modern Physics Lab - **Spring Only** | PHYS 34300 |  | 1 | C- | Co-requisite: PHYS 34200 |
| Differential Equations | MA 26400 |  | 3 | C- | MA 26100 |
| Social Sciences Elective | Any Gen Ed Social Science course | X | 3 |  |  |
| General Thermodynamics I - **Spring Only** | ME 30500 |  | 3 | C- | MA 26100 and PHYS 26100 |

**Semester Five Total Credits = 16**

| **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 |
| Fluid Mechanics - **Fall Only** | ME 31200 |  | 3 | C- |  |
| Software Tools for Engineers | ENGR 15100 (Also allowed CS 12300 – Programming I: Java, or CIS 16600 – Introduction to Programming) | X | 3 | C- | MA 15900 or MA 15400 or ALEKS Placement 085 |
| Fluid Mechanics Laboratory - **Fall Only** | ME 31300 |  | 1 | C- |  |

**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 |
| Nuclear Power - **(H) Spring Only (even years)** | PHYS 34700 |  | 3 | C- | MA 26100 and PHYS 25100 and PHYS 34200 |
| Programming II: C++ | CS 12400 (Also allowed ECE 15200 - Programming for Engineers, CIS 26300 - Java Programming, or CIS 26600 - C++ Programming) |  | 3 | C- | CS 12300 |
| Linear Algebra | MA 26500 |  | 3 | C- | MA 16400 |
| Physics Elective | Any PHYS or ASTR course 30000 level or higher |  | 3 | C- |  |
| Free Elective | Any Free Elective |  | 1 |  |  |

**Semester Seven Total Credits = 12**

| **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)** | PHYS 40200 **(e)** |  | 2 | C- |  |
| Nuclear Physics - **(H) Fall Only (even years)** | PHYS 34800 |  | 3 | C- | MA 26100 and PHYS 25100 and PHYS 34200 |
| Free Elective | Any Free Elective |  | 3 |  |  |

**Semester Eight Total Credits = 16**

| **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 |
| Heat Transfer - **Spring Only** | ME 41600 |  | 3 | C- | ME 30500 and ME 31200 and ME 313 |
| Heat Transfer Laboratory - **Spring Only** | ME 41700 |  | 1 | C- | ME 31300 |
| Neutron Physics - **(H) Spring Only (odd years)** | PHYS 44900 |  | 3 | C- | PHYS 34700 |

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, ECE, ENGR, ME or PHYS courses) must be at least 2.50.

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)