Dual Program Agreement

Department of Physics
Department of Physics, Nuclear and Electrical Engineering

Agreement

For An Articulated Physics/Nuclear Engineering Dual Program Between
South Dakota State University and Idaho State University

I. INTRODUCTION

Based upon a mutual respect for the integrity of dual academic programs and in an effort to better serve students desiring fundamental knowledge in physics as well as pursuing careers in Nuclear Engineering; South Dakota State University (SDSU) and Idaho State University (ISU) hereby enter into an agreement for an articulated Dual program that upon a student’s successful completion in its entirety will result in a BS in Physics from SDSU and a MS in Nuclear Science and Engineering from ISU. Efficient completion of the program by students will encompass 3 years of attendance at SDSU followed by 2 years of attendance at ISU.

Objectives of the Agreement:

1. To attract qualified students to South Dakota State University and to Idaho State University for the purpose of providing enhanced STEM training in furtherance of student goals and for the purpose of developing the national workforce of qualified Nuclear Engineers and Nuclear Scientists which will benefit the nation and the sovereign states of Idaho and South Dakota.
2. To facilitate the transition of students from SDSU to ISU.
3. To provide specific advisement for students of SDSU who intend to pursue the study of Nuclear Science and Engineering at ISU.
4. To encourage academic and administrative coordination between institutions, and the exchange of evaluative information on the outcomes of the program with the goal of continual improvement.
5. To provide qualified students the opportunity to complete the BS degree in Physics from SDSU and to complete the MS in Nuclear Science and Engineering in a total of five years (three at SDSU, two at ISU).

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1. Under the provisions of this agreement, students will matriculate at SDSU for a minimum of 99 semester credits of course work leading toward the BS in Physics – Elective Group 3 (Flexible Emphasis). The student then matriculates to ISU for a minimum of 47 semester credits of course work leading toward the MS in Nuclear Science and Engineering. See Attachments I, II, and III for a detailed listing.
2. While enrolled at SDSU or ISU, students will complete all required course work as outlined in article (1) above and described in the pertinent sections of the matriculation year catalogs of SDSU and ISU; excepting requirements stipulated in article (11).
3. Upon completion of the first year of studies at ISU a maximum of 21 ISU semester credits (12 graduate credits and 9 undergraduate credits) may be transferred for completion of the B.S. in Physics at SDSU. An official transcript must be sent from ISU to the registrar of SDSU, and the student must request and submit application materials for graduation from SDSU. The courses that can serve as transferred credits from ISU are indicated in Attachment III.

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8. The SDSU Department of Physics will provide necessary assistance and documentation that is required by the ISU Department of Physics, Nuclear, and Electrical Engineering for admission and degree accreditation requirements.

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10. During their study at ISU, in order to facilitate the transfer of ISU credits to SDSU, the student’s status with SDSU shall be maintained with the use of the hiatus code.

11. Stipulations:
   a. All South Dakota Regental System Graduation Requirements and SDSU Institutional Graduation requirements as outlined by the SDSU Matriculation Year catalog will be satisfied by the student either through coursework completed at SDSU, including transferred credits, or through transferred credits from ISU with the following clarifications/stipulations for students enrolled in this dual program:
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The majority of the requirement, 80%, will be satisfied in the first 64 credits and all system general education requirements must be completed prior to matriculation at ISU.

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South Dakota State University and Idaho State University both agree to encourage qualified students to participate in this dual degree program through advisement and dissemination of information. The Coordinator of Nuclear Education at SDSU will make every effort to maintain a list of students actively pursuing the program with the intent to enroll at ISU and will periodically inform appropriate liaison within the Department of Nuclear Engineering and Health Physics at ISU who will facilitate necessary communication with the ISU admissions office.

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V. CONTINUATION AND TERMINATION OF THE AGREEMENT

This agreement shall be in force until either institution makes a decision in writing to terminate the agreement. It is agreed that if terminated, both institutions will honor the terms of the agreement until all

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As program graduation requirements change at either institution, this agreement will be updated by communicating the changes in the form of revision of the attachments to this agreement and will not, in and of itself, require revision of the agreement. The communication of curricular changes will occur in a timely fashion to enable either institution a chance to review the changes and decide if they are significant enough to warrant revising or terminating the agreement.

**South Dakota State University**

Head, Department of Physics

Dean, College of Arts and Sciences

Dean, Graduate School

Provost and Executive Vice-President for Academic Affairs

**Idaho State University**

Program Director for Nuclear Engineering

Department of Physics, Nuclear, Electrical Engineering

Dean, College of Science and Engineering

Provost and Vice-President for Academic Affairs
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**SGR #1: Written Communication**
- ENGL 101 – Composition I 3 credits
- ENGL 201 OR 277 – Composition II OR Technical Writing 3 credits

**SGR #2: Oral Communication**
- SPCM 101 – Fundamentals of Speech 3 credits

**SGR #3: Social Sciences / Diversity**
(6 hours in 2 disciplines)
- 6 credits

**SGR #4: Humanities and Arts / Diversity**
(6 hours in 2 disciplines OR a foreign language sequence)
- 6 credits

**SGR #5: Mathematics**
- MATH 123 – Calculus I 4 credits

**SGR #6: Natural Sciences**
- PHYS 211 and 211L – University Physics I and Laboratory 4 credits
- PHYS 213 and 213L – University Physics II and Laboratory 4 credits

**IGR #1: First Year Seminar**
- UC 109 – First Year Seminar 2 credits

**IGR #2: Cultural Awareness and Social and Environmental Responsibility**
- 3 credits

**Total**
- 38 credits

SDSU Department of Physics Liaison:
Dr. Robert McTaggart – Coordinator for Nuclear Education
robert.mctaggart@sdstate.edu

\(^2\) Consult the SDSU Undergraduate Catalog for all courses that satisfy SGR or IGR requirements. Students in this program will be exempted from the requirement that all 30 credits of the System General Education Requirements must be completed within the first 64 hours. SDSU general education requirements must be completed prior to matriculation to ISU.
Attachment II: Requirements for the BS in Physics at SDSU completed prior to the MS in Nuclear Science and Engineering at ISU.

**General Education Requirements** *(See Attachment I)*

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHEM 112 and 112L – General Chemistry I and Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 114 and 114L – General Chemistry II and Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>MATH 125 – Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 225 – Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 321 – Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>CSC 150 – Computer Science I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 316 and 316L – Measurement Theory and Experiment Design and Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 318 – Advanced Laboratory I</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 331 – Introduction to Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 421 – Electromagnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 451 – Classical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 490 – Seminar (Capstone)</td>
<td>2</td>
</tr>
<tr>
<td>EE 220 and 220L – Circuits I and Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 341 – Thermodynamics</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 343 – Statistical Mechanics</td>
<td>2</td>
</tr>
</tbody>
</table>

**Major Requirements (47 credit hours)**

<table>
<thead>
<tr>
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<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 112 and 112L – General Chemistry I and Laboratory</td>
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</tr>
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<td>4</td>
</tr>
<tr>
<td>MATH 125 – Calculus II</td>
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<tr>
<td>MATH 225 – Calculus III</td>
<td>4</td>
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<td>3</td>
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<tr>
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</tr>
<tr>
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<td>2</td>
</tr>
<tr>
<td>PHYS 343 – Statistical Mechanics</td>
<td>2</td>
</tr>
</tbody>
</table>

**Electives (36 credit hours):**

**Technical Electives (7 credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE 435 – Introduction to Nuclear Engineering</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 471 – Quantum Mechanics</td>
<td>4</td>
</tr>
</tbody>
</table>

**Free Electives (9 credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM 331 – Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 418 – Advanced Laboratory II</td>
<td>1</td>
</tr>
</tbody>
</table>

**Directed Electives (19 credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coursework transferred to SDSU from Idaho State University³</td>
<td>21</td>
</tr>
</tbody>
</table>

³ A maximum of 12 ISU graduate credits may be used as directed electives; the other nine will be ISU UG credits. Nineteen of the transferred credits will satisfy the directive elective requirement and 2 of the transferred credits will count towards the free electives.
Attachment III: Plan of Study for the MS in Nuclear Science and Engineering at Idaho State University under this agreement.

At ISU, During Year 1 (Semesters 1 and 2), the 3-2 student will be considered an undergraduate with permission to take graduate level (5000 and 6000) courses. Undergraduates must maintain a minimum 12-credit load to be considered full time. A maximum of 12 graduate credits may be transferred to SDSU for completion of the BS in Physics at SDSU. The remainder of the 21 transferred credits must be undergraduate credits. ISU prefixes MATH, CE, NE, and NSEN will be transferred as SDSU prefixes MATH, CEE, NE, and GEN respectively.

**Required courses for 3-2 BS/MS program**: 

<table>
<thead>
<tr>
<th>Semester 1 (Fall)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2240 - Linear Algebra</td>
<td>3 credits*&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>CE 3361 - Engineering Economics and Management</td>
<td>3 credits*&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>NSEN 6684 - Nuclear Engineering Basics I (F)</td>
<td>3 credits**&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>MATH 5521 - Advanced Engineering Math I (F)</td>
<td>3 credits&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>NE 5551 - Seminar (F/S)</td>
<td>1 credit**</td>
</tr>
<tr>
<td><strong>13 credits total</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester 2 (Spring)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NSEN 6685 - Nuclear Engineering Basics II (S)</td>
<td>3 credits**&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>HPHY 5516 - Radiation Detection and Measurement (S)</td>
<td>3 credits**&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>MATH 5522 - Advanced Engineering Math II (S)</td>
<td>3 credits&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>NE 5519 - Energy Systems and Nuclear Power (S)</td>
<td>3 credits&lt;sup&gt;†&lt;/sup&gt;</td>
</tr>
<tr>
<td>ME 4476 - Heat Transfer</td>
<td>1 credit**</td>
</tr>
<tr>
<td>NE 5551 - Seminar (F/S)</td>
<td></td>
</tr>
<tr>
<td><strong>16 credits total</strong></td>
<td></td>
</tr>
</tbody>
</table>

During Year 2 (Semesters 3 and 4) the 3-2 student will be considered a graduate student and therefore must maintain a minimum 9-credit load of 5000 and 6000 level courses to be considered full time.

<table>
<thead>
<tr>
<th>Semester 3 (Fall)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NE 5546 - Reactor Physics</td>
<td>3 credits**</td>
</tr>
<tr>
<td>NSEN 6601 - Nuclear Engineering Experiments (F)</td>
<td>3 credits**</td>
</tr>
</tbody>
</table>

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<sup>†</sup> It is expected that students will work on their research during the summer between Years 1 and 2 and, if necessary for completion, the summer after Year 2.
Course choice from optional list or 3 research credits (ENGR 6650) 3 credits
9 credits total

Semester 4 (Spring)
NE 5546 – Nuclear Fuel Cycle (S) 3 credits**
ENGR 6650 – Thesis Research (F/S/Su) 3 credits**
Course choice from optional list or add 3 research credits (ENGR 6650) 3 credits
9 credits total

Summer Semester
ENGR 6650 – Thesis Research (F/S/Su) at least 1 credit**

Total credits = at least 48

* These courses will not count toward the MS degree but will be transferrable to SDSU.

**Courses to be transferred to SDSU to complete the BS in Physics degree at SDSU

**These courses are required for MS NSEN students with undergraduate degree not in nuclear engineering. A total of 6 research credits is required; however, more may be taken to meet the requirements for full time credit load and for continuous enrollment (including summer semesters) until completion of thesis.

All required 3-credit and lab courses are offered once a year, in the semesters indicated in parentheses (F=Fall, S=Spring).

Optional courses (not necessarily offered every year)
NE 5558- Monte Carlo Methods 3 credits
NE 5578 – Reliability and Risk Assessment 3 credits
NE 5588 - Nonproliferation and Nuclear Safeguards 3 credits
NE 5599 - Methods and Practice in Criticality Safety 3 credits
NE 5599 – Introduction to Nuclear Security 3 credits
NE 5599 – Introduction to Plasma Physics 3 credits
NSEN 6603 – Thermal Hydraulics 3 credits
NSEN 6604 – Dynamic Behavior of Nuclear Systems 3 credits
NSEN 6608 – Radiation Transport 3 credits
NSEN 6618 – Radioactive Waste Management 3 credits
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South Dakota State University

[Signature]
Head, Department of Physics

[Signature]
Dean, College of Arts and Sciences

[Signature]
Dean, Graduate School

Idaho State University

[Signature]
Program Director for Nuclear Engineering
Department of Physics, Nuclear, Electrical Engineering

[Signature]
Dean, College of Science and Engineering

[Signature]
Provost and Vice-President for Academic Affairs

Provost and Executive Vice-President for Academic Affairs

August 22, 2016
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**SGR #6: Natural Sciences**
- PHYS 211 and 211L – University Physics I and Laboratory 4 credits
- PHYS 213 and 213L – University Physics II and Laboratory 4 credits

**IGR #1: First Year Seminar**
- UC 109 – First Year Seminar 2 credits

**IGR #2: Cultural Awareness and Social and Environmental Responsibility** 3 credits

**Total** 38 credits

SDSU Department of Physics Liaison:
- Dr. Robert McTaggart – Coordinator for Nuclear Education
  robert.mctaggart@sdstate.edu

\(^2\)Consult the SDSU Undergraduate Catalog for all courses that satisfy SGR or IGR requirements. Students in this program will be exempted from the requirement that all 30 credits of the System General Education Requirements must be completed within the first 64 hours. SDSU general education requirements must be completed prior to matriculation to ISU.
Attachment II: Requirements for the BS in Physics at SDSU completed prior to the MS in Nuclear Science and Engineering at ISU.

**General Education Requirements** *(See Attachment I)*

38 credits

**Major Requirements (47 credit hours):**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 112</td>
<td>General Chemistry I and Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 114</td>
<td>General Chemistry II and Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>MATH 125</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 225</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 321</td>
<td>Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>CSC 150</td>
<td>Computer Science I</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 316</td>
<td>Measurement Theory and Experiment Design and Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 318</td>
<td>Advanced Laboratory I</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 331</td>
<td>Introduction to Modern Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 421</td>
<td>Electromagnetism</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 451</td>
<td>Classical Mechanics</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 490</td>
<td>Seminar (Capstone)</td>
<td>2</td>
</tr>
<tr>
<td>EE 220</td>
<td>Circuits I and Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 341</td>
<td>Thermodynamics</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 343</td>
<td>Statistical Mechanics</td>
<td>2</td>
</tr>
</tbody>
</table>

**Electives (36 credit hours):**

- **Technical Electives (7 credit hours):**
  - NE 435 - Introduction to Nuclear Engineering           | 3 credits |
  - PHYS 471 - Quantum Mechanics                           | 4 credits |

- **Free Electives (9 credit hours):**
  - EM 331 - Fluid Mechanics                               | 3 credits |
  - PHYS 418 - Advanced Laboratory II                      | 1 credit |
  - Electives                                              | 5 credits |

**Directed Electives (19 credit hours):**

**Total**                                                                                   120 credits

**Coursework transferred to SDSU from Idaho State University**

21 credits

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3 A maximum of 12 ISU graduate credits may be used as directed electives; the other nine will be ISU UG credits. Nineteen of the transferred credits will satisfy the directive elective requirement and 2 of the transferred credits will count towards the free electives.
Attachment III: Plan of Study for the MS in Nuclear Science and Engineering at Idaho State University under this agreement.

At ISU, During Year 1 (Semesters 1 and 2), the 3-2 student will be considered an undergraduate with permission to take graduate level (5000 and 6000) courses. Undergraduates must maintain a minimum 12-credit load to be considered full time. A maximum of 12 graduate credits may be transferred to SDSU for completion of the BS in Physics at SDSU. The remainder of the 21 transferred credits must be undergraduate credits. ISU prefixes MATH, CE, NE, and NSEN will be transferred as SDSU prefixes MATH, CEE, NE, and GEN respectively.

### Required courses for 3-2 BS/MS program:

#### Semester 1 (Fall)
- **MATH 2240** - Linear Algebra: 3 credits
- **CE 3361** - Engineering Economics and Management: 3 credits
- **NSEN 6684** - Nuclear Engineering Basics I (F): 3 credits
- **MATH 5521** - Advanced Engineering Math I (F): 3 credits
- **NE 5551** - Seminar (F/S): 1 credit

13 credits total

#### Semester 2 (Spring)
- **NSEN 6685** - Nuclear Engineering Basics II (S): 3 credits
- **HPHY 5516** - Radiation Detection and Measurement (S): 3 credits
- **MATH 5522** - Advanced Engineering Math II (S): 3 credits
- **NE 5519** - Energy Systems and Nuclear Power (S): 3 credits
- **ME 4476** - Heat Transfer: 3 credits
- **NE 5551** - Seminar (F/S): 1 credit

16 credits total

During Year 2 (Semesters 3 and 4) the 3-2 student will be considered a graduate student and therefore must maintain a minimum 9-credit load of 5000 and 6000 level courses to be considered full time.

#### Semester 3 (Fall)
- **NE 5546** - Reactor Physics: 3 credits
- **NSEN 6601** - Nuclear Engineering Experiments (F): 3 credits

- It is expected that students will work on their research during the summer between Years 1 and 2 and, if necessary for completion, the summer after Year 2.
Dual Program Agreement
Department of Physics
Department of Physics, Nuclear and Electrical Engineering

Course choice from optional list or 3 research credits (ENGR 6650) 3 credits
9 credits total

Semester 4 (Spring)
NE 5546 – Nuclear Fuel Cycle (S) 3 credits**
ENGR 6650 – Thesis Research (F/S/Su) 3 credits**
Course choice from optional list or add 3 research credits (ENGR 6650) 3 credits
9 credits total

Summer Semester
ENGR 6650 – Thesis Research (F/S/Su) at least 1 credit**

Total credits = at least 48

* These courses will not count toward the MS degree but will be transferrable to SDSU.
† Courses to be transferred to SDSU to complete the BS in Physics degree at SDSU
**These courses are required for MS NSEN students with undergraduate degree not in nuclear engineering. A total of 6 research credits is required; however, more may be taken to meet the requirements for full time credit load and for continuous enrollment (including summer semesters) until completion of thesis.

All required 3-credit and lab courses are offered once a year, in the semesters indicated in parentheses (F=Fall, S=Spring).

Optional courses (not necessarily offered every year)
NE 5558- Monte Carlo Methods 3 credits
NE 5578 – Reliability and Risk Assessment 3 credits
NE 5588 - Nonproliferation and Nuclear Safeguards 3 credits
NE 5599 - Methods and Practice in Criticality Safety 3 credits
NE 5599 – Introduction to Nuclear Security 3 credits
NE 5599 – Introduction to Plasma Physics 3 credits
NSEN 6603 – Thermal Hydraulics 3 credits
NSEN 6604 – Dynamic Behavior of Nuclear Systems 3 credits
NSEN 6608 – Radiation Transport 3 credits
NSEN 6618 – Radioactive Waste Management 3 credits
NSEN 6631 – Advanced Reactor Physics 3 credits