

## New Proposal

Date Submitted: 12/04/23 11:33 am

# Viewing: : Nuclear, Plasma, and Radiological Engineering + Data Science, BS

Last edit: 10/02/24 9:36 am

Changes proposed by: Becky Meline

### In Workflow

1. U Program Review
2. 1973 Head
3. 1434 Head
4. 1992 Head
5. 1257 Head
6. 1583 Head
7. LP Committee Chair
8. KP Committee Chair
9. LP Dean
10. KV Dean
11. KP Dean
12. University Librarian
13. COTE Programs
14. Provost
15. Senate EPC
16. Senate
17. U Senate Conf
18. Board of Trustees
19. IBHE
20. HLC
21. DMI

### Approval Path

1. 12/04/23 11:38 am  
Emily Stuby (eastuby):  
Approved for U Program Review
2. 12/04/23 11:59 am  
Rizwan Uddin (rizwan):  
Approved for 1973 Head
3. 12/13/23 3:18 pm  
Margaret Fleck (mfleck):

- Approved for 1434  
Head
4. 01/03/24 10:02  
am  
Catherine Blake  
(clblake):  
Approved for 1992  
Head
5. 01/04/24 10:00  
am  
Lee DeVille  
(rdeville):  
Approved for 1257  
Head
6. 01/04/24 6:18 pm  
Bo Li (libo):  
Approved for 1583  
Head
7. 01/09/24 6:02 pm  
Lisa Bievenue  
(bievenue):  
Approved for LP  
Committee Chair
8. 03/22/24 9:31 am  
Ashley Hallock  
(ahallock):  
Approved for KP  
Committee Chair
9. 03/22/24 11:15  
am  
Catherine Blake  
(clblake):  
Approved for LP  
Dean
10. 04/10/24 2:30 pm  
Stephen Downie  
(sdownie):  
Approved for KV  
Dean
11. 04/10/24 2:44 pm  
Cindy Pruitt  
(cpruitt):  
Approved for KP  
Dean
12. 04/25/24 6:00 am  
Claire Stewart  
(clairest):  
Approved for

- University  
Librarian
13. 04/25/24 8:03 am  
Suzanne Lee  
(suzannel):  
Approved for  
COTE Programs
  14. 04/25/24 8:37 am  
Brooke Newell  
(bsnewell):  
Rollback to KP  
Committee Chair  
for Provost
  15. 05/02/24 3:43 pm  
Ashley Hallock  
(ahallock):  
Approved for KP  
Committee Chair
  16. 05/03/24 9:45 am  
Amber Holmes  
(aflowers):  
Approved for LP  
Dean
  17. 05/03/24 10:18  
am  
Stephen Downie  
(sdownie):  
Approved for KV  
Dean
  18. 05/03/24 10:23  
am  
Cindy Pruitt  
(cpruitt):  
Approved for KP  
Dean
  19. 05/09/24 11:18  
am  
Claire Stewart  
(clairest):  
Approved for  
University  
Librarian
  20. 05/09/24 5:20 pm  
Suzanne Lee  
(suzannel):  
Approved for  
COTE Programs
  21. 05/10/24 9:47 am

- Brooke Newell  
(bsnewell):  
Rollback to KP  
Committee Chair  
for Provost
22. 05/13/24 10:43  
am  
Ashley Hallock  
(ahallock):  
Approved for KP  
Committee Chair
23. 05/13/24 12:37  
pm  
Amber Holmes  
(aflowers):  
Approved for LP  
Dean
24. 05/13/24 12:53  
pm  
Stephen Downie  
(sdownie):  
Approved for KV  
Dean
25. 05/13/24 1:09 pm  
Cindy Pruitt  
(cpruitt):  
Approved for KP  
Dean
26. 05/13/24 3:05 pm  
Claire Stewart  
(clairest):  
Approved for  
University  
Librarian
27. 05/13/24 4:00 pm  
Suzanne Lee  
(suzannel):  
Approved for  
COTE Programs
28. 08/15/24 11:46  
am  
Brooke Newell  
(bsnewell):  
Approved for  
Provost

Proposal Type

Proposal Type:  
Major (ex. Special Education)

## Administration Details

|                              |   |   |
|------------------------------|---|---|
| Official Program Name        | Nuclear, Plasma, and Radiological Engineering + Data Science, BS                            |   |
| Diploma Title                | Bachelor of Science in Nuclear, Plasma, and Radiological Engineering + Data Science         |   |
| Sponsor College              | Grainger College of Engineering   |   |
| Sponsor Department           | Nuclear, Plasma & Rad Engr  |   |
| Sponsor Name                 | Rizwan Uddin, Department Head   |   |
| Sponsor Email                | rizwan@illinois.edu   |   |
| College Contact              | Jonathan Makela, Associate Dean for Undergraduate Programs, Grainger College of Engineering | College Contact Email<br>jmakela@illinois.edu |
| College Budget Officer       | Tessa Hile  |   |
| College Budget Officer Email | tmhile@illinois.edu   |   |

List the role for rollbacks (which role will edit the proposal on questions from EPC, e.g., Dept Head or Initiator) and/or any additional stakeholders. Purpose: List here who will do the editing work if proposal needs rolled back. And any other stakeholders.

Tomasz Kozlowski, Associate Head for Undergraduate Programs - EPC questions and rollback  
Becky Meline, Sr. Coordinator of Undergraduate Programs - edits to proposal and rollback

Does this program have inter-departmental administration?  
Yes

Interdisciplinary Colleges and Departments (list other colleges/departments which are involved other than the sponsor chose above)

Please describe the oversight/governance for this program, e.g., traditional departmental/college governance. Inclusion of/roles of elected faculty committees? Inclusion of/roles of any advisory committees.

In Spring 2017, the College of Liberal Arts & Sciences submitted an Investment for Growth Proposal to “Jump Start Data Science”, focusing on undergraduate data science education. Interim Provost John Wilkin supported the proposal, but called on LAS to work with three colleges (Engineering, the iSchool, and the Gies College of Business) to develop a collaborative approach to undergraduate data science at Illinois.

Those deans formed a task force (herein the “Data Science Education Task Force” or DSETF) to explore opportunities and make proposals for undergraduate data science education at Illinois. The DSETF conducted its work during academic years 2017—2018 and 2018—2019. At the core of their work was the vision that every Illinois undergraduate should have the opportunity to have a meaningful exposure to data science.

In February 2019, the four deans agreed to support a shared framework for X+Data Science majors, based on suggestions from the DSETF. The framework consisted of the following pieces.

- 1) A set of core competencies and common features which will be expected of X+Data science majors, together with a reference standard set of courses and activities that fulfills the data science portion of those expectations.
- 2) Each college can propose its own X+Data Science majors, which will be majors of that college. They may differ from the reference standard approach. When they do so, they should explain how the proposed major provides the expected competencies and features of an X+Data Science major in a manner that is appropriate for their students.
- 3) The deans will engage with the campus leadership to establish a Data Science Education committee. The committee will:
  - Keep track of offerings related to data science to facilitate collaboration and reduce redundancy
  - Facilitate the development of data science programs by connecting undergraduate data science education resources across the university
  - Advise colleges on matters related to undergraduate data science education
  - Review X+Data Science major proposals, commenting on how they meet the expectations for X+Data Science majors and engage collaboratively and strategically with the university’s resources in data science education

The Nuclear, Plasma, and Radiological Engineering + Data Science program is a degree involving the study of data science in the context of Nuclear, Plasma, and Radiological Engineering. It will be offered as a collaboration of the Department of Nuclear, Plasma, and Radiological Engineering with the Departments of Computer Science, Mathematics, Statistics, and the School of Information Sciences.

College                      Grainger College of Engineering

Department                Siebel School Comp & Data Sci

Is there an additional department involved in governance?

Yes

College Information Science, School of

Department Information Sciences

Is there an additional department involved in governance?

Yes

College Liberal Arts & Sciences

Department Mathematics

Is there an additional department involved in governance?

Yes

College Liberal Arts & Sciences

Department Statistics

## Proposal Title

Effective Catalog Term Fall 2024

Proposal Title (either Establish/Revise/Eliminate the Degree Name in Program Name in the College of XXXX, i.e., Establish the Bachelor of Science in Entomology in the College of Liberals Art and Sciences, include the Graduate College for Grad Programs)

Establish the Bachelor of Science in Nuclear, Plasma, and Radiological Engineering plus Data Science in The Grainger College of Engineering

Does this proposal have any related proposals that will also be revised during the next 6 weeks? Consider Majors, Minors, Concentrations & Joint Programs in your department. Please know that this information is used administratively to move related proposals through workflow efficiently. Example: If you are revising the BS proposal and one related concentration within the next 6 weeks, "This BS proposal (key 567) is related to the Concentration A proposal (key 145)."

No

## Program Justification

Provide a brief justification of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

The Bachelor of Science in Nuclear, Plasma, and Radiological Engineering + Data Science at the University of Illinois Urbana-Champaign simultaneously incorporates a strong foundation in data science with a program of study in nuclear, plasma, and radiological engineering. The program includes substantial research or discovery experiences as part of the degree. Briefly, the BS in Nuclear, Plasma, and Radiological Engineering + Data Science (BS in NPRE + Data Science) is comprised of these three components:

1. Coursework from the Data Science core (29 credit hours):

a. This coursework is comprised of:

- i. Two (2) courses from Mathematics (7 hours)
- ii. Two (2) courses from Statistics (8 hours)
- iii. Two (2) courses from Computer Science (8 hours)
- iv. Two (2) Courses from the I-School (6 hours)

2. Coursework from the area of Nuclear, Plasma, and Radiological Engineering (70 credit hours):

a. This coursework is comprised of:

- i. Courses in Orientation and Professional Development (2 hours)
- ii. Courses in Foundational Mathematics and Science (22 hours)
- iii. Courses in the Nuclear, Plasma, and Radiological Engineering Technical Core (46 hours)

3. A meaningful research/discovery experience (4 credit hours). NPRE 458 Design in NPRE provides knowledge of and develops skill in applying basic principles of definition, organization, constraints, modeling, and optimization of system design using case studies and class design projects that use these design principles.

In addition to the 103 credit hours above, all students will complete the Campus General Education requirements including the campus general education language requirement. One of the Social and Behavioral Science courses must be an introductory economics course (ECON 102 or ECON 103). Free Electives are included as additional course work, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree. There are a minimum 128 hours required for graduation, in line with other undergraduate programs in the Grainger College of Engineering. This includes a minimum of 40 hours of upper-division coursework, required for graduation.

40 hour upper division/advanced course requirement

4 credit hours: CS 307

3 credit hours: IS 467

3 credit hours: IS 477

4 credit hours: ME 310 or TAM 335

3 credit hours: NPRE 321

3 credit hours: NPRE 330



2 credit hours: NPRE 349  
4 credit hours: NPRE 441  
4 credit hours: NPRE 445  
3 credit hours: NPRE 449  
3 credit hours: NPRE 451  
4 credit hours: NPRE 455  
4 credit hours: NPRE 458

Ubiquitous digital technology and the generation of massive amounts of data are rapidly transforming society and multiple fields of inquiry. The transformation has created exciting opportunities and worrisome scenarios across multiple domains of human endeavor. Like the industrial technologies of the early -20th century, the new digital technologies of the early-21st century have great potential to transform society, for good or ill. The University of Illinois has a high calling to prepare students to lead society's digital transformation.

There is substantial demand, both from students and from employers, for educational programs in data science. A 2017 study by researchers at IBM and Burning Glass Technologies predicted the demand for Data Scientists would grow by 28% by 2020. U.S. Bureau of Labor Statistics predicts 36% growth in jobs for data scientists (much higher than average for all professions) over 2021-2031 (<https://www.bls.gov/ooh/math/data-scientists.htm>). Furthermore, Enrollment in the undergraduate majors "Statistics" and "Statistics and Computer Science," which provide students access to some of the competencies of data science, have grown by a factor of six in the last ten years.

Data science is emerging as a subject of great importance in many domains of human and scholastic endeavor. National policy documents for data science majors emphasize that engagement with an application domain is an important part of data science education. The University of Illinois' white paper on data science education recommended the development of "X+Data Science majors" as an approach to offering broad collaborative opportunities for Illinois students to engage with data science.

The areas of study and research in Nuclear, Plasma, and Radiological Engineering increasingly involve modeling, simulation, numerical analysis, and use of computational methods. Being able to gather, organize, interpret, and analyze the large amount of data that is produced from these efforts is becoming an increasingly in-demand skill set of employers and graduate programs. In proposing the Nuclear, Plasma, and Radiological + Data Science, BS program we recognize the interdisciplinary importance and benefits of combining data science with the domain specific NPRE discipline. The primary objective of this program would be to provide an emphasis for our students in the NPRE domain discipline while adding breadth in the direction of data science in their studies. A related outcome of this program would be to promote data science in the NPRE discipline and as a result increase competitiveness and widen the opportunities of our graduates as they enter a data driven economy. Development of the NPRE + DS BS program aligns with the campus-wide initiative to develop X+DS interdisciplinary education in Data Science. The proposed program by combining DS with domain specific expertise will be distinguished by attributes that are not available together in any individual degree program in the UI System nor in the state of Illinois.

The University of Illinois Urbana-Champaign (UIUC) has developed the "X+Data Science Majors" (X+DS) framework as a systematic way to offer its students the opportunity to study data science while engaging with an application domain. The X+DS degrees at UIUC (where five have already been approved) are comprised of three different components:

- The data science core coursework in Mathematics, Statistics, Computer Science, and Information Sciences.
- The coursework in the X major (X in this being case Nuclear, Plasma, and Radiological Engineering).
- A meaningful research discovery experience (at least 3 credit hours).

The structure of the proposed Nuclear, Plasma, and Radiological Engineering + Data Science program follows the precedent "X+DS programs" that were approved thus far by IBHE (Astronomy + DS, Accountancy + DS, Business + DS, Finance + DS, and Information Sciences + DS).

The major exceeds the minimum 40 credit hours in upper division courses at 43 hours of 300 and 400 level courses in the curriculum.

The Nuclear, Plasma, and Radiological Engineering + Data Science program is a degree involving the study of data science in the context of nuclear, plasma, and radiological engineering. It is offered as a collaboration of the Department of Nuclear, Plasma, and Radiological Engineering and the Departments of Computer Science, Mathematics, Statistics, and the School of Information Sciences.

## Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No

Does this new program/proposed change result in the replacement of another program?

No

Does the program include other courses/subjects outside of the sponsoring department impacted by the creation/revision of this program?

Yes

Courses outside  
of the sponsoring  
department/interdisciplinary  
departments

ENG 100 - Engineering Orientation  
CHEM 102 - General Chemistry I  
CHEM 103 - General Chemistry Lab I

MATH 220 - Calculus  
MATH 221 - Calculus I  
MATH 227 - Linear Algebra for Data Sci  
MATH 231 - Calculus II  
MATH 241 - Calculus III  
MATH 257 - Linear Algebra w Computat Appl  
MATH 285 - Intro Differential Equations  
PHYS 211 - University Physics: Mechanics  
PHYS 212 - University Physics: Elec & Mag  
ME 200 - Thermodynamics  
ME 310 - Fundamentals of Fluid Dynamics  
TAM 210 - Introduction to Statics  
TAM 212 - Introductory Dynamics  
TAM 335 - Introductory Fluid Mechanics  
CS 277 - Algo & Data Stru for Data Sci  
CS 307 - Model & Learning in Data Sci  
STAT 107 - Data Science Discovery  
STAT 207 - Data Science Exploration  
IS 467 - Ethics & Policy for Data Scien  
IS 477 - Data Mgmt, Curation, & Reprodu  
ECON 102 - Microeconomic Principles  
ECON 103 - Macroeconomic Principles

Please attach any [NPRE+DS Degree 2023 Complied Letters of Support](#)  
letters of [11-29-23.pdf](#)  
support/acknowledgement  
for any  
Instructional  
Resources  
consider faculty,  
students, and/or  
other impacted  
units as  
appropriate.

## Program Regulation and Assessment

### Plan to Assess and Improve Student Learning

*Illinois Administrative Code: 1050.30(b)(1)(D) Provision is made for guidance and counseling of students, evaluations of student performance, continuous monitoring of progress of students toward their degree objectives and appropriate academic record keeping.*

List the program's student learning outcomes. Each outcome should identify what students are expected to know and/or be able to do upon completing this program.

Student learning outcomes are based on learning outcomes in line with the ABET accreditation process for Nuclear Engineering.

Nuclear, Plasma, & Radiological Engineering + Data Science graduates will have:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Further, the Department of Nuclear, Plasma, and Radiological Engineering has undergraduate curriculum program education objectives (PEOs) that prepare our graduates to succeed in early career (two to five years post-graduation) professional activities in paths related to the NPRE discipline. Student learning outcomes represent process-orientated activities that either directly or in combination prepare students to satisfy all program educational objectives upon completion of the BS NPRE + Data Science degree program. These PEOs are:

1. To succeed as engineers in the 21st Century in a globally-connected technological environment in which best practices are shared internationally free of borders.
2. To advance in career paths associated with the NPRE disciplines, including commercial nuclear power, plasma sciences and technology, and radiological sciences related opportunities.
3. To pursue further academic growth, obtaining advanced degrees in disciplines related, but not limited, to the disciplines associated with NPRE technical areas.
4. To provide leadership to professional and societal communities in a general way and

in ways specific to the NPRE disciplines.

5. To engage in life-long learning and professional development, staying abreast of the ever-evolving technological landscape related to the NPRE disciplines.

6. To contribute to society in a professional, responsible and ethical manner.

Describe how, when, and where these learning outcomes will be assessed.

Describe here:

There is an established review process wherein:

- a) The work products for each of 1-7 outcomes are determined by each instructor in consultation with the Associate Head for undergraduate Programs (frequency is approximately once every two years). The level of mastery is determined by each instructor and is reviewed by the Undergraduate Associate Head. Generally work products require levels of mastery at 75% or higher.
- b) Instructors collect course work products and distill these into a numerical score. The instructor determines the percentage of students obtaining mastery for each work product. The instructor generates a document that includes the performance of the student body in the course with respect to the outcome and number of students that achieved mastery. These reports are forwarded to the Associate Head for Undergraduate Programs for review (frequency: each semester).
- c) Periodically, the Undergraduate Curriculum subcommittee reviews the reports. This review then serves as a basis for modification of either the course or elements of the NPRE + DS curriculum. The Undergraduate Curriculum subcommittee reviews the assessment's work products periodically to ensure these continue to be appropriate for 1-7 outcome assessment. Instructors are consulted if the review determines that changes in work products are warranted (frequency is approximately once every two years).

In addition to the above, the Instructor & Course Evaluation System (ICES) is used to carry out assessment at the end of each semester for each class. The assessment provides vital feedback on faculty and teaching assistant performance and the impact on general teaching and learning issues.

Further, ABET Accreditation will provide assurance that the NPRE + DS program is in line with the quality standards for which the program prepares graduates to enter the profession. This review will be provided every six years.

Finally, Senior Exit Surveys will be implemented. The survey will provide data based on student satisfaction with the program as well as ABET objectives.

The assessment of student outcomes forms the basis of the NPRE Department's continuous improvement process for the undergraduate curriculum. These are routinely reviewed by the Associate Head for Undergraduate Programs and by the Undergraduate Curriculum Subcommittee.

Suggestions for changes and improvements in the academic program are encouraged and sought from all members of the Department constituencies. Suggestions may be submitted formally or informally, or may develop from a general assessment of changes in the discipline due to local, national, or international policies or trends. Suggestions for changes or improvements are considered by the Faculty, typically in faculty meetings or in ad hoc subcommittees of the Faculty. Individuals or groups may develop substantive proposals for changes which would be implemented pending a positive response from the Faculty in consultation with the constituencies.

Identify faculty expectations for students' achievement of each of the stated student learning outcomes. What score, rating, or level of expertise will signify that students have met each outcome? Provide rating rubrics as necessary.

Overall, each student must maintain a minimum GPA of 2.0 each semester to avoid being placed on academic probation, and furthermore must not be placed on academic probation for more than 2 consecutive semesters to avoid being considered for dismissal from the program. A student who earns a GPA less than 1.0 during any semester is dismissed from the program. A student must maintain a minimum cumulative GPA of 2.0 to graduate. Further, NPRE has a minimum Technical GPA requirement for graduation of 2.0 in the two courses NPRE 200 and NPRE 247.

Regarding achievements related to the learning objectives, NPRE faculty in each class will identify their own problem sets, exam questions, or other assignments that relate meaningfully to specific individual outcomes. The level of mastery is determined by each instructor, generally work products require levels of mastery at 75% or higher.

Explain the process that will be implemented to ensure that assessment results are used to improve student learning.

The Associate Head of Undergraduate Programs and Senior Coordinator of Undergraduate Programs in the NPRE department will monitor individual students for academic performance, and notify, engage with, and support those who land on academic probation. In addition, the Associate Head of Undergraduate Programs, working together with the NPRE Curriculum subcommittee, will review the course outcomes satisfaction result metrics that each faculty provides in order to assure satisfactory performance and will follow up in specific cases where performance is less than satisfactory.

Program  
Description and  
Requirements  
Attach Documents

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

## Program of Study

*Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: <https://www.ibhe.org/assets/files/PublicAdminRules2017.pdf>). For proposals for new bachelor's degrees, if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.*

Attach Program of Study-related information such as sample sequences (for undergraduate programs) or college-level [SampleSequenceNPRE+Data\\_PROPOSED\\_BJM\\_02\\_19\\_24.docx](#)

forms.

### Catalog Page Text - Overview Tab

Description of program for the catalog page. This is not official content, it is used to help build the new catalog page for the program. Can be edited in the catalog by the college or department.

For the Degree of Bachelor of Science in the Grainger College of Engineering

Nuclear, Plasma, and Radiological Engineering + Data Science

Statement for

Programs of

#### **Graduation Requirements**

Study Catalog

Minimum hours required for graduation: 128 hours.

Minimum Overall GPA: 2.0

Minimum [Technical GPA](#): 2.0

TGPA is required for [NPRE 200](#) and [NPRE 247](#). See [Technical GPA](#) to clarify requirements.

#### **University Requirements**

Minimum of 40 hours of upper-division coursework, generally at the 300- or 400-level. These hours can be drawn from all elements of the degree. Students should consult their academic advisor for additional guidance in fulfilling this requirement.

The university and residency requirements can be found in the [Student Code](#) (§ 3-801) and in the [Academic Catalog](#).

#### **General Education Requirements**

Follows the [campus General Education \(Gen Ed\) requirements](#). Some Gen Ed requirements may be met by courses required and/or electives in the program.

|      |  | Course List |       |
|------|--|-------------|-------|
| Code | Title  |             | Hours |
|      | Composition I  |             | 4-6   |
|      | Advanced Composition   |             | 3     |
|      | Humanities & the Arts (6 hours)  |             | 6     |
|      | Natural Sciences & Technology (6 hours)  |             | 6     |
|      | fulfilled by <a href="#">CHEM 102</a> , <a href="#">PHYS 211</a> , <a href="#">PHYS 212</a>  |             |       |
|      | Social & Behavioral Sciences (6 hours)   |             | 6     |
|      | fulfilled by <a href="#">ECON 102</a> or <a href="#">ECON 103</a> and any other course approved as Social & Behavioral Sciences  |             |       |
|      | Cultural Studies: Non-Western Cultures (1 course)  |             | 3     |
|      | Cultural Studies: US Minority Cultures (1 course)  |             | 3     |
|      | Cultural Studies: Western/Comparative Cultures (1 course)  |             | 3     |
|      | Quantitative Reasoning (2 courses, at least one course must be Quantitative Reasoning I)   |             | 6-10  |
|      | fulfilled by <a href="#">MATH 220</a> or <a href="#">MATH 221</a> ; and <a href="#">MATH 231</a> , <a href="#">MATH 241</a> , <a href="#">MATH 285</a> , <a href="#">PHYS 211</a> , <a href="#">PHYS 212</a> , <a href="#">STAT/CS/IS 107</a> , and <a href="#">STAT 207</a> |             |       |
|      | Language Requirement (Completion of the third semester or equivalent of a language other than English is required)   |             | 0-15  |

#### **Nuclear, Plasma, and Radiological Engineering Orientation and Professional Development**

##### Course List

| Code                     | Title                                    | Hours |
|--------------------------|--|-------|
| <a href="#">ENG 100</a>  | Grainger Engineering Orientation Seminar | 1     |
| <a href="#">NPRE 100</a> | Orientation to NPRE                      | 1     |
| Total Hours              |  | 2     |

#### **Introductory Economics Elective**



Course List

| Code                        | Title                    | Hours |
|-----------------------------|--------------------------|-------|
| <a href="#">ECON 102</a>    | Microeconomic Principles | 3     |
| or <a href="#">ECON 103</a> | Macroeconomic Principles |       |
| Total Hours                 |                          | 3     |

**Nuclear, Plasma, and Radiological Engineering Mathematics and Science Foundations**

Course List

| Code                     | Title                          | Hours |
|--------------------------|--------------------------------|-------|
| <a href="#">CHEM 102</a> | General Chemistry I            | 3     |
| <a href="#">CHEM 103</a> | General Chemistry Lab I        | 1     |
| <a href="#">MATH 231</a> | Calculus II                    | 3     |
| <a href="#">MATH 241</a> | Calculus III                   | 4     |
| <a href="#">MATH 285</a> | Intro Differential Equations   | 3     |
| <a href="#">PHYS 211</a> | University Physics: Mechanics  | 4     |
| <a href="#">PHYS 212</a> | University Physics: Elec & Mag | 4     |
| Total Hours              |                                | 22    |

**Nuclear, Plasma, and Radiological Engineering Core**

Course List

| Code                       | Title   | Hours |
|----------------------------|---|-------|
| <a href="#">ME 200</a>     | Thermodynamics  | 3     |
| <a href="#">ME 310</a>     | Fundamentals of Fluid Dynamics                                | 4     |
| or <a href="#">TAM 335</a> | Introductory Fluid Mechanics                                  |       |
| <a href="#">NPRE 200</a>   | Mathematics for Nuclear, Plasma, and Radiological Engineering | 2     |
| <a href="#">NPRE 247</a>   | Modeling Nuclear Energy System                                | 3     |
| <a href="#">NPRE 321</a>   | Introduction to Plasmas and Applications                      | 3     |
| <a href="#">NPRE 330</a>   | Materials in Nuclear Engineering                              | 3     |
| <a href="#">NPRE 349</a>   | Introduction to NPRE Heat Transfer                            | 2     |
| <a href="#">NPRE 441</a>   | Radiation Protection  | 4     |
| <a href="#">NPRE 445</a>   | Interaction of Radiation with Matter                          | 4     |
| <a href="#">NPRE 449</a>   | Nuclear Systems Engineering and Design                        | 3     |
| <a href="#">NPRE 451</a>   | NPRE Laboratory   | 3     |
| <a href="#">NPRE 455</a>   | Neutron Diffusion & Transport                                 | 4     |
| <a href="#">TAM 210</a>    | Introduction to Statics                                       | 2     |
| <a href="#">TAM 212</a>    | Introductory Dynamics   | 3     |
| Total Hours                |   | 46    |

**Data Science Core**

Course List

| Code                           | Title   | Hours |
|--------------------------------|---|-------|
| Mathematical Foundations       |   | 7     |
| <a href="#">MATH 221</a>       | Calculus I ( <a href="#">MATH 220</a> may be substituted. <a href="#">MATH 220</a> is appropriate for students with no background in calculus. 4 of 5 credit hours count towards degree.) | 4     |
| <a href="#">MATH 227</a>       | Linear Algebra for Data Science   | 3     |
| or <a href="#">MATH 257</a>    | Linear Algebra with Computational Applications  |       |
| Data Science Fundamentals      |   | 12    |
| <a href="#">STAT/CS/IS 107</a> | Data Science Discovery  | 4     |
| <a href="#">STAT 207</a>       | Data Science Exploration  | 4     |
| <a href="#">CS 307</a>         | Modeling and Learning in Data Science   | 4     |

| Code                     | Title   | Hours |
|--------------------------|---|-------|
|                          | Computational Fundamentals                      | 4     |
| <a href="#">CS 277</a>   | Algorithms and Data Structures for Data Science | 4     |
|                          | Social Impact in Data Science                   | 6     |
| <a href="#">IS 467</a>   | Ethics and Policy for Data Science              | 3     |
| <a href="#">IS 477</a>   | Data Management, Curation & Reproducibility     | 3     |
|                          | Research or Discovery Experience                | 4     |
| <a href="#">NPRE 458</a> | Design in NPRE                                  | 4     |
|                          | Total Hours                                     | 33    |

### Free Electives

|   |  | Course List                           |       |
|---|--|---------------------------------------|-------|
| Code  |  | Title                                 | Hours |
| <a href="#"><u>Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree.</u></a> |  |                                       |       |
|   |  | Total Hours of Curriculum to Graduate | 128   |

Corresponding Degree      BS Bachelor of Science

## Program Features

Academic Level      Undergraduate

Does this major have transcribed concentrations?      No

What is the typical time to completion of this program?  
4 years

What are the minimum Total Credit Hours required for this program?  
128

CIP Code      142301 - Nuclear Engineering.

Is This a Teacher Certification Program?  
No

Will specialized accreditation be sought for this program?  
Yes

Describe the plans for seeking specialized accreditation:

The NPRE Department at UIUC will seek to receive accreditation for the proposed BS in Nuclear, Plasma, and Radiological Engineering + Data Science program under the Nuclear and Radiological program category of ABET, the Accreditation Board for Engineering and Technology. When mapped to the Nuclear and Radiological Engineering BS ABET criteria, the proposed curriculum satisfies requirements including engineering course hours.

ABET accreditation will provide assurance that the NPRE core of the NPRE + DS program is in line with the quality standards for which the program prepares graduates to enter the profession. This review will be provided every six years. The BS in Nuclear, Plasma, and Radiological Engineering has been accredited since 1978 (as Nuclear Engineering 1978 - 2012; as Nuclear, Plasma, and Radiological Engineering 2012 - present). The Department is due for its next ABET review in 2025.

## Delivery Method

This program is available:

On Campus - Students are required to be on campus, they may take some online courses.

## Admission Requirements

Desired Effective Admissions Term      Fall 2024

Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

Application processing at the freshman level will be administered by the Office of Undergraduate Admissions, with requirements commensurate with standards of Grainger College of Engineering.

Admission Requirements for Freshmen:

- The general admission requirements of the University apply
- Application fee
- Self-reported academic record (SRAR)
- English proficiency

International students must score at least 100 on the iBT version of the English as a Foreign Language test (TOEFL); or 7 on each section of the IELTS.

For more detailed information regarding application requirements and the application process, please visit the University of Illinois Admissions website at: [www.admissions.illinois.edu](http://www.admissions.illinois.edu).

Admissions Requirements for Inter-College/Department Transfer Students and Engineering Undeclared Students (ICT/IDT/EU)

- Students originating outside of the Grainger College of Engineering who entered the University of Illinois Urbana-Champaign as first-time freshmen will be required to participate in the Engineering Undeclared Program to be reviewed for transfer into Nuclear, Plasma, and Radiological Engineering + Data Science.
- Engineering Undeclared and current University students should demonstrate an interest in the major by:
  - Earning grades of "B" or better in introductory courses such as CHEM 102, 103; MATH 221, 231; PHYS 211; and STAT 107.
  - Maintain a cumulative and specialized GPA of 3.00 or higher
  - Successfully complete the ICT or IDT transfer application

Number of Students in Program (estimate)

|                   |    |   |    |
|-------------------|----|---|----|
| Year One Estimate | 16 | 5th Year Estimate (or when fully implemented) | 75 |
|-------------------|----|---|----|

Estimated Annual Number of Degrees Awarded

|                   |   |   |    |
|-------------------|---|---|----|
| Year One Estimate | 0 | 5th Year Estimate (or when fully implemented) | 15 |
|-------------------|---|---|----|

What is the matriculation term for this program? Fall

## Budget

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

No

Additional Budget  
Information

Departments of Mathematics, Statistics, Computer Science and the I-School are coordinating to provide support for advising in data science.

Attach File(s)

## Financial Resources

How does the unit intend to financially support this proposal?

No additional financial resources are expected to be needed.

Will the unit need to seek campus or other external resources?

No

Attach letters of  
support

What tuition rate do you expect to charge for this program? e.g, Undergraduate Base Tuition, or Engineering Differential, or Social Work Online (no dollar amounts necessary)

Engineering Differential

## IBHE

### Degree Program Title and Overview

What is the specific title of the proposed degree program as it would be listed in the IBHE Program Inventory? The name should be what typically is used for similar programs nationally. Provide a short description of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates.

Bachelor of Science in Nuclear, Plasma, and Radiological Engineering + Data Science

Program Description: The Bachelor of Science in Nuclear, Plasma, and Radiological Engineering + Data Science at the University of Illinois Urbana-Champaign simultaneously incorporates a strong foundation in data science with a program of study in nuclear, plasma, and radiological engineering. The degree program is expected to be completed in eight semesters of full time study and will be offered by the Nuclear, Plasma, and Radiological Engineering Department (NPRE) in the Grainger College of Engineering (GCOE) in collaboration with Computer Science Department in GCOE, Information Sciences Department in the School of Information Sciences, Mathematics Department in the College of Liberal Arts and Sciences (LAS), and Statistics Department in LAS. The proposed program will be distinguished by attributes that are not available together in any individual degree program in the UI System, in the state of Illinois, or in the nation, specifically:

- 1) coursework from the Data Science core including Mathematics, Statistics, Computer Science, Information Sciences (29 credit hours),
- 2) coursework from the area of Nuclear, Plasma, and Radiological Engineering discipline including Orientation and Professional Development, Foundational Mathematics and Science, NPRE Technical Core (70 credit hours),
- 3) A capstone senior design course which provides a meaningful research/discovery experience involving the basic design principles of definition, organization, constraints, modeling, and optimization of system design using case studies and class design projects (4 credit hours).

In addition to the above, all students complete the Campus General Education requirements including the campus general education language requirement. Free Electives are included as additional course work, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree.

Data Science Demand: Ubiquitous digital technology and the generation of massive amounts of data are rapidly transforming society and multiple fields of inquiry. The transformation has created exciting opportunities and worrisome scenarios across multiple domains of human endeavor. Like the industrial technologies of the early -20th century, the new digital technologies of the early-21st century have great potential to transform society, for good or ill. The University of Illinois has a high calling to prepare students to lead society's digital transformation.

There is substantial demand, both from students and from employers, for educational programs in data science. A 2017 study by researchers at IBM and Burning Glass Technologies predicts the demand for Data Scientists would grow by 28% by 2020. US Bureau of Labor Statistics predicts 36% growth in jobs for data scientists (much higher

than average for all professions) over 2021-2031 (<https://www.bls.gov/ooh/math/data-scientists.htm>). Furthermore, Enrollment in the undergraduate majors "Statistics" and "Statistics and Computer Science," which provide students access to some of the competencies of data science, have grown by a factor of six in the last ten years.

Data science is emerging as a subject of great importance in many domains of human and scholastic endeavor. National policy documents for data science majors emphasize that engagement with an application domain is an important part of data science education. The University of Illinois' white paper on data science education recommended the development of "X+Data Science majors" as an approach to offering broad collaborative opportunities for Illinois students to engage with data science.

**NPRE + DS Relationship:** The areas of study and research in Nuclear, Plasma, and Radiological Engineering increasingly involve modeling, simulation, numerical analysis, and use of computational methods. Being able to gather, organize, interpret, and analyze the large amount of data that is produced from these efforts is becoming an increasingly in demand skill set of employers and graduate programs. In proposing the Nuclear, Plasma, and Radiological + Data Science, BS program we recognize the interdisciplinary importance and benefits of combining data science with the domain specific NPRE discipline. The primary objective of this program would be to provide an emphasis for our students in the NPRE domain discipline while adding breadth in the direction of data science in their studies. A related outcome of this program would be to promote data science in the NPRE discipline and as a result increase competitiveness and widen the opportunities of our graduates as they enter a data driven economy. Development of the NPRE + DS BS program aligns with the campus-wide initiative to develop X+DS interdisciplinary education in Data Science.

**Alignment with University Initiatives:** UIUC has developed the "X+Data Science Majors" (X+DS) framework as a systematic way to offer its students the opportunity to study data science while engaging with an application domain. The X+DS degrees at UIUC (where five have already been approved) are comprised of three different components:

- The data science core coursework in Mathematics, Statistics, Computer Science, and Information Sciences.
- The coursework in the X major (in this case Nuclear, Plasma, and Radiological Engineering).
- A meaningful research discovery experience (at least 3 credit hours).

The structure of the proposed Nuclear, Plasma, and Radiological Engineering + Data Science program follows the precedent "X+DS programs" that were approved thus far by IBHE (Astronomy + DS, Accountancy + DS, Business + DS, Finance + DS, and Information Sciences + DS).

*Illinois Administrative Code: 1050.30(a)(1): A) The objectives of the unit of instruction, research or public service are consistent with the mission of the college or university; B) The objectives of the unit of instruction, research or public service are consistent with what the unit title implies.*

# Institutional Context

University of Illinois at Urbana-Champaign

Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built.



Explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

#### Institutional Context

The Nuclear Engineering discipline has a well-established history on the University of Illinois Urbana-Champaign campus with discussions on establishing a program on campus pre-dating the President Eisenhower Atomic Energy Act of 1954. The Nuclear Engineering program began with the master's degree curriculum in 1958 and the establishment of the PhD degree program followed soon thereafter. By 1976 the program graduated its first bachelor's degree awardees. Ten years later, in 1986, the status of Nuclear Engineering was changed from "program" to that of "department". The name of the unit was changed to the Department of Nuclear, Plasma, and Radiological Engineering in 2003 to reflect the breadth of the areas of study and its applications. A change in the degree's names to Nuclear, Plasma, and Radiological Engineering followed. Currently, the department administers bachelor's, master's, and doctor of philosophy degree programs in Nuclear, Plasma, and Radiological Engineering. The department also oversees for the Grainger College of Engineering the Master's of Engineering in Energy Systems and in Plasma Engineering programs.

The U.S. Bureau of Labor Statistics (BLS) has projected a 36% growth in Data Science occupations during the period of 2021 to 2031 driven by the demand for workers who can handle big data. BLS projects that occupations in Data Science and Mathematical Science will far outpace the average growth rate for all occupations. To address this projected demand, the University of Illinois Urbana-Champaign has launched an initiative to develop a series of undergraduate degrees that combine Data Science with other disciplines, X + DS. These X + DS programs are intended to be interdisciplinary, with students taking core coursework in their domain discipline alongside their Data Science coursework. These X + DS programs are also intended to be inclusive, with core Data Science coursework having fewer technical prerequisites and requirements than most programs in computer science, mathematics, or statistics which in turn will make them more accessible to students from various backgrounds. There are currently four X + DS programs offered at the University of Illinois Urbana-Champaign: Accountancy + Data Science, Astronomy + Data Science, Finance + Data Science, and Information Sciences + Data Science, with a fifth Business + Data Science recently having been approved, therefore there is precedent for such programs on the University of Illinois Urbana-Champaign campus.

There has been a growth of data science in recent years across all disciplines including that of engineering, and specifically here as it pertains to the fields of nuclear, plasma, and radiological engineering (NPRE). The areas of study and research in NPRE increasingly involve modeling, simulation, numerical analysis, and use of computational methods. Being able to gather, organize, interpret, and analyze the large amount of data that is produced from these efforts is becoming an increasingly in-demand skill set of employers and graduate programs.

The NPRE department currently has 13 FTE faculty members and several open tenure-track positions. The FTE faculty support the five primary research areas of Materials Science, Nuclear Power, Plasma Physics and Fusion, Radiological Science and Reliability and Risk. Data Science is an in-demand and applicable skill set across all of the sub-areas

Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

The university continually examines its educational programs to respond to emerging student demand, societal need, and economic opportunity. Data science has rapidly emerged as a field for which there is broad-based demand across many areas of economic activity and across many fields of scholarship. The university recognized this in its 2018 - 2023 Strategic Plan "The Next 150" which included among its goals to "Establish Illinois as the global leader in digital transformation at the service of society" through in part bolstering our strength in among other related areas data science. The plan called on to "Provide all Illinois students the opportunity to have a meaningful exposure to data science". The degree program proposed here is part of that response.

Discuss projected future employment and/or additional educational opportunities for graduates of this program. Compare estimated demand with the estimated supply of graduates from this program and existing similar programs in the state. Where appropriate, provide documentation by citing data from such sources as employer surveys, current labor market analyses, and future workforce projections. (Whenever possible, use state and national labor data, such as that from the Illinois Department of Employment Security at <http://lmi.ides.state.il.us/> and/or the U.S. Bureau for Labor Statistics at <http://www.bls.gov/>).

With regard to employment outlook, one of the main motivators for the development of this B.S. in Nuclear, Plasma, and Radiological Engineering + Data Sciences degree is the market demand for students trained in collecting, cataloging, analyzing, and interpreting large quantities of data and applying in the context of the NPRE fields of study.

The ubiquity of massive data sets has created enormous demand for data scientists across many domains, including that of Engineering. As a supportive example, enrollment in the Statistics major has increased seven-fold in the last ten years, and other majors that involve data science have seen similar explosion in interest. But there is tremendous demand not only for coding-intensive data scientists but also for data scientists who can work collaboratively in application domains, including that of Engineering, and here specifically in the NPRE application areas (power generation, plasma-materials processing, semi-conductor design and fabrication, fusion development, detector development for national security applications, imaging device design for medical uses, reliability and risk).

What resources will be provided to assist students with job placement?

To support job placement, students will have access to the Grainger College of Engineering Career Services (ECS). ECS hosts two major career fairs per year which are very well attended by recruiters searching for Illinois talent for internships, co-ops, and permanent positions. In addition, ECS offers advising and support resources on various related topics such as career exploration, networking, the job search process, cover letters, resumes, interviewing, salary and offer negotiation, etc. In an effort of transparency, ECS publishes a Illini Success Annual Report along with a Three Year Trend Report, and they administer a Salary and Hiring Data Portal. At the department level, NPRE has a large network of alumni and industry and national lab constituents who are invested in our student success. This network serves as a further support for student placement that is separate from ECS efforts. Many graduates and our constituents come to campus specifically to recruit from NPRE as they know the caliber of the program and our graduates.

If letters of support are available attach them here:

## Comparable Programs in Illinois

*Illinois Administrative Code: 1050.30(a)(6): B) The unit of instruction, research or public service meets a need that is not currently met by existing institutions and units of instruction, research or public service. For additional information about similar programs, check the Degree Program Inventory on the IBHE website ([https://www.ibhe.org/ProgInv\\_Prog.aspx](https://www.ibhe.org/ProgInv_Prog.aspx)) and review the Notice of Intent website for programs being planned (<https://legacy2.ibhe.org/ODA/tracking/NOI/NOISearch.asp>).*

Identify similar programs and sponsoring institutions in the state, at both public and private colleges and universities. Compare the proposed program with these programs, and discuss its potential impact upon them. Provide complete responses, do not reference website links.

The Department of Nuclear, Plasma, and Radiological Engineering offers the only Nuclear Engineering program at any of the bachelors, masters or doctoral level in the State of Illinois.

Under the Data Science, General category UIUC is the only public university offering bachelors degrees through our X + DS programs. The other institutions listed in the IBHE database - Dominican University, Olivet Nazarene University (BS Data Science); Trinity Christian College (BA Data Analytics); and Lake Forest College (BA DS - Finance & Economics) are offered though comparatively, smaller, independent institutions.

It follows that the Nuclear, Plasma, and Radiological Engineering + Data Science BS program, being the only Nuclear Engineering program in the State of Illinois, would fulfill a unique niche.

Comparable Programs in Illinois Attach Documents

## A Thriving Illinois: Higher Education Paths to Equity, Sustainability, and Growth

IBHE is charged to develop a strategic plan to address the present and future aims and needs and requirements of higher education in Illinois (110 ILCS 205/6) (from Ch. 144, par. 186) Sec. 6). Illinois Administrative Code:

1050.30(a)(6): A) The unit of instruction, research or public service is educationally and economically justified based on the educational priorities and needs of the citizens of Illinois Respond to the following questions about how the proposed program will support the three goals of A Thriving Illinois: Higher Education Paths to Equity, Sustainability, and Growth Strategic Plan.

## Equity

Describe institutional-level plans to close equity gaps in access, progression, completion, and attainment and the implications for the proposed program. More specifically, provide institutional-level plans for attracting, recruiting, retaining, and completing a diverse group of students including working adults, students of color, transfer and low-income students and implications for the proposed program. Explain how progress will be monitored.

Institution-level plans: Access, progression, completion, and attainment

At the System level, the University of Illinois prioritizes closing equity gaps among the citizens across Illinois, within our urban and rural communities, and beyond. While the fundamental needs that will drive greater economic vitality vary greatly across zip codes in the state, it is clear that closing equity gaps among our citizens remains crucial to achieving the mission of the University of Illinois System.

Supportive of IBHE's A Thriving Illinois plan and aligning its Equity Strategy #2, the UI System's Access 2030 Strategic Plan is a comprehensive initiative designed to increase the number of graduates from underrepresented groups by 50 percent by the end of the decade. This will include students from disadvantaged backgrounds – ethnic and racial, rural, and urban. This initiative will strengthen the University of Illinois' bedrock commitment to the public good, ensuring that as we work to improve life in our state, we are not leaving communities behind. It will build on ongoing efforts to create more opportunities for Illinoisans of all backgrounds. The initiative is being tooled to close equity gaps throughout the pipeline, working from K-12 through college, including our community colleges. Access 2030 embodies Equity Goal 2 of A Thriving Illinois, providing a framework for and supporting the three institutions' equity plans.

In addition to Access 2030, the University of Illinois System is engaged in various programs and supports aimed at student recruitment and retention. One such program is Salute to Academic Achievement (SAA). SAA has run for almost 40 years, with students from underrepresented minority groups and low-sending counties invited either by academic performance GPA and test or by GPA and high school nomination to attend a college-fair type event. Participants are recognized for academic achievements, and have the opportunity to meet with college, admissions, financial aid, and housing representatives from all three UI System universities. Participants also receive fee waivers for future admissions applications for each university along with an individualized Certificate of Academic Achievement. In Fall 2021, 4,585 students were invited, 640 RSVP-ed, and 548 attended.

The President's Award Program (PAP) and PAP Honors provide financial support for students admitted to one of the UI Systems three institutions from historically underrepresented groups. The PAP award is \$5,000 per year available for a maximum of four years while the PAP Honors Program awards \$10,000 per year for four years. Over \$244 million has been distributed between 2006 and 2020.

A third example of System level support is the UI System Transfer Guarantee Program, which aligns with Growth Strategy #8. Cognizant that many underrepresented minority students begin their higher education journeys at community colleges, this program guarantees admission to students who apply to any of the three campuses if they graduated from an Illinois high school, attended an Illinois community college, and

attained 36 graded credit hours and a minimum 3.0 GPA.

At the institution level, the University of Illinois Urbana-Champaign's (UIUC) diversity, equity, and inclusion work is led by the Office of the Vice Chancellor for Diversity, Equity, and Inclusion (OVCDEI). The OVCDEI's goals, ongoing assessments, and initiatives impact students as well as faculty and staff, and student-focused programming sets the tone for the institution's efforts as they relate to all of A Thriving Illinois' equity strategies. In the 2022-2023 academic year, the institution will be launching a campus-wide climate assessment instrument to understand the degree to which students feel safe, accepted, and valued. The goal is to provide a quantitative sense of how individuals feel about their campus experiences. This assessment will include students' perceptions of the quality of their interactions with peers, faculty members, and administrators, including their sense of the campus as a place where they belong and are treated with respect. The university is partnering with the Association of American Universities (AAU), external organizations, and peer institutions to ensure the survey instrument is state of the art, has questions that shed light on multiple axes of diversity, and generates data that can be shared and benchmarked against peer institutions to tease out challenges that are unique to the UIUC campus as well as those that are common to peer universities.

In keeping with the institutional framework led by the OVCDEI, the University of Illinois Urbana-Champaign is engaged with a number of efforts to strategically support and bolster equity on campus. For example, in July, 2020, the university pledged \$2 million annually for the Chancellor's Call to Action to Address Racism and Social Injustice to focus the intellectual and scholarly talent of the university to examine two of the greatest challenges facing society and seek new solutions. The 2021 submitted proposals underwent a vigorous and scholarly review that included pre-proposal submission, evaluation, a request to prepare a fully proposal, further assessment from both internal and external evaluators, and funding notification. Ninety-two proposals were submitted and 22 were funded, for a total of \$1,630,373. The remainder of the funds will support a symposium and other programmatic operations. Principle Investigators leading the funded proposals represent eight colleges and two administrative units across 17 departments.

Critical efforts on the UIUC campus surround activities related to closing the graduation gap and increasing student success. UIUC is an active participant in the American Talent Initiative, with Chancellor Robert Jones serving on ATI's steering committee. ATI is focused on expanding student access to high graduation-rate institutions, with the goal of enrolling and graduating 50,000 additional high-achieving, low-and moderate-income students from these institutions by the year 2025. The University of Illinois Urbana-Champaign has targeted the following goals: 1. Target a six-year graduation rate for Pell students; 2. increase targeted opportunities for incoming students to participate in summer scholar/bridge programming in an attempt to increase the number of Pell students enrolling, improve retention rates, and reduce graduate rate gaps for this population.

Additionally, the university is a leader in the Association of Public and Land Grant Universities Powered by Publics (APLU PxP) initiative. The goals of APLU PxP are to produce several hundred thousand more degrees by 2025: to eliminate the

achievement gap for low-income, minority, and first-generation students; and to expand access to higher education for students from all backgrounds. One hundred thirty (130) universities and state systems participate in 16 transformation “clusters.” UIUC is the lead in the Big Ten Academic Alliance (BTAA) Cluster, which is studying retention and persistence starting with a focus on foundational course “DFW” rates to determine barriers faced by students pursuing degree advancement and align best practices to address those challenges. BTAA Cluster institutions identified courses common across institutions and looked at the total enrollment on census date, number of D grades, number of F grades, and number of course withdrawals from the Fall 2016, Spring 2017, Fall 2017, Spring 2018, Fall 2018, and Spring 2019 terms. To illustrate the connection between DFW and progress to degree, BTAA institutions exchanged metrics based on DF grades in the first semester. Sub-cohorts of the 2014 new freshman entrance cohort were sorted based on the number of D/F grades in the first term. The graduation gap between students who had one D/F grade and those without any was 19.9%; the gap for those with more than one D/F grade was 47.3%. UIUC has begun to use these data to examine foundational course curriculum and determine additional supports needed for students in these courses.

Aligned with the goals of the ATI and APLU work is the campus’ Student Success Initiative (SSI). Goals of the SSI are to: 1. increase access (reduce cost of attendance, increase aid, consider time to degree); 2. eliminate equity gaps (increase retention and graduation rates for underrepresented and minoritized students); 3. improve the Illinois experience (abandon “sink or swim” mentality, identify and broaden campus programs, support services, and opportunities for engagement). In February 2022, SSI hosted the inaugural Student Success Symposium, which engaged over 200 faculty, staff, and students. A variety of other projects emerged from SSI that have enabled the university to provide greater focus on recruitment efforts. United with the university’s Mental Health Working Group, a comprehensive wellness website was implemented, the Faculty and Staff Mental Health Ambassador Program was piloted, and a Mental Health statement for syllabi was implemented. SSI members contributed to the planning of a UI System-wide Mental Health Symposium and received a \$5,000 grant to create Wellness Spaces on campus. Working toward a more streamlined Learning Management System (LMS) experience for students, SSI team members helped faculty migrate materials to Canvas. Additionally, in response to COVID-related learning loss, the Provost’s office funded \$750,000 in grants for instructional support and innovative programs, as recommended by an SSI first-year experience task force. Through recommendations from SSI task groups to reduce classroom materials costs, the Provost’s office provided grant funding for faculty to adopt, adapt, and create Open Educational Resources. An SSI implementation team reviewed Article 3 of the Student Code on Academic Policies and Regulations with an equity lens, provided findings to the Provost’s office, and recommended policy changes to be implemented in the 2022-2023 Student Code. Building on the work of the APLU PxP BTAA Cluster, another SSI Implementation team examined DFW information in University of Illinois Urbana-Champaign courses. In the upcoming academic year, the SSI will focus on: 1. better understanding and improving the first-year student experience broadly and the transfer student experience specifically; increasing access to the institution for underrepresented students; and providing professional development for faculty to ensure excellent student experiences and outcomes regardless of where a student is located

Finally, the university's recruitment plan and programming aligns with A Thriving Illinois and with the Office of Undergraduate Admissions' statement on their Diversity Site. The university offers a number of outreach and recruitment programs geared toward historically underrepresented minority students such as Discover Illinois and Días de Visita en Español geared toward underrepresented populations. The University of Illinois Urbana-Champaign moved to test-optional, with ACT/SAT scores optional for all first-year applicants. Test scores are not required to be considered for merit-based or honors programs. In alignment with A Thriving Illinois Growth Strategy 8 to strengthen the statewide, coordinated transfer system to ensure students have seamless paths to build on previous academic learning and earn postsecondary credentials, the University of Illinois Urbana-Champaign has multiple transfer pathway programs. The Parkland Pathway program allows students to dual enroll at Parkland College and UIUC while living in UIUC residence halls. There are also intensive advising partnerships with City Colleges of Chicago, Danville Area Community College, Illinois Central College, and Rock Valley College. UIUC recently implemented Public Act 102-0187, the Public University Uniform Admission Pilot, which guarantees transfer students admission to the university if they meet minimum requirements.

College, Department, and Program-level plans: Access, progression, completion, and attainment

Within The Grainger College of Engineering, the Morrill Engineering Program (MEP), Women in Engineering (WIE) program, and the Academic Redshirt in Science and Engineering (ARISE) program support students from underserved and underrepresented backgrounds in engineering. These programs facilitate successful student engagement and retention through peer mentoring, community building, proactive advising, and academic support. Each program offers opportunities for students to experience the onset of their adjustment to the university with others from similar backgrounds. Peer mentors assist in welcoming students to campus by sharing best practices on how to navigate the social, academic, and professional opportunities for development. MEP engages first-year students from underrepresented backgrounds in its MEP Mentoring Course (ENG 111). This course promotes academic skill-building, professional development, and campus engagement while using peer mentors as role models for best practices. From the onset of the student's experience on campus, the ARISE program helps develop academic study skills and career/curricular exploration in students who often arrive to campus without the exposure and resources that most students have available. The overall annual operating budget to support these programs is approximately \$670,000, with the financial resources allocated to support recruitment, retention, programming, and assessment efforts.

Illinois recently adopted the Common App, which aligns with the recommendation in Equity Strategy 5 of A Thriving Illinois (consider implementation of a direct admissions program) and Growth Strategy 4 (encourage high school graduates to enroll in our higher education system and keep talent in Illinois). While the admissions process is handled at the University level, recruitment and retention activities are undertaken collaboratively between the College and each academic program. The goal is to enroll a class that is representative of the State of Illinois and the United States, more broadly. Obtaining this goal is, unfortunately, still years off and will require an increase in the

Obtaining this goal is, unfortunately, still years off and will require an increase in the diversity of student applications and those who successfully matriculate into Grainger Engineering programs, as well as continued efforts in increasing retention to graduation. Significant effort has gone into recruiting students from backgrounds underrepresented in the current population. These efforts include development of public outreach and engagement opportunities in high schools as well as programs such as summer camps and high school research experiences aimed at overcoming opportunity gaps. Grainger Engineering offers 19 distinct summer camp programs to provide pre-college students early engagement opportunities and serve as recruitment tools for the college. By providing students from underrepresented populations with opportunities to experience success we aim to help pre-college students see themselves as future engineers, programmers, mathematicians, and scientists who can succeed in the College.

The Engineering Pathways program aligns with A Thriving Illinois Growth Strategy 8 (strengthen the statewide, coordinated transfer system to ensure students have seamless paths to build on previous academic learning and earn postsecondary credentials) in providing 2+2 agreements and guaranteed transfer for students in the Pathways. Engineering Pathways offers students interested in beginning their college education at a partner community college a streamlined transfer experience and guaranteed admission to The Grainger College of Engineering upon successful completion of program requirements. As a best practice, the program utilizes a cohort-based model and supports students with an array of services including academic advising, tutoring, and mentoring; orientations and events; opportunities for major exploration and professional development; early engagement with Grainger Engineering and the University of Illinois; and an 8-week summer transition program (GearUP) designed to reduce transfer shock, shorten time to degree completion, and increase post-transfer retention.

To increase program accessibility, Engineering Pathways has expanded entry points beyond the traditional high school to college transition. The program works in close collaboration with community college partners on funding and access initiatives such as the Bridges into Engineering and Computer Science summer experience offered at Wilbur Wright College, which focuses on increasing the number of underrepresented students entering engineering and computer science through math preparation for calculus. The cost savings for students who pursue admission via Engineering Pathways is substantial, providing increased access to engineering degree programs.

Between summer and fall terms of 2019 and 2020, 230 transfer students entered the Grainger College of Engineering. The program breakdown for these students are: 141 non-Engineering Pathways, 64 general Engineering Pathways, and 25 GearUP Engineering Pathways participants. 64% of GearUP Engineering Pathways participants graduated within 2-years, compared to only 36% of Engineering Pathways students who did not participate in GearUP and 23% of non-Engineering Pathways students that did not participate in GearUP (these statistics are affected by the COVID-19 pandemic, which has generally increased time-to-degree for many students). This preliminary data suggests that the GearUP program is achieving the intended function to bridge technical course gaps and keep students on track to timely graduation. In addition, \$194,000 has been provided in scholarship support to program participants from



Engineering Pathways, made possible through generous support from private and corporate sponsors. Grainger Engineering continues to develop and grow this program in response to A Thriving Illinois Growth Strategy 1: Scale summer bridge programs, extend learning opportunities to mitigate learning loss and accelerate time to degree, and provide proactive and comprehensive advising and Strategy 2: Establish and implement institution-level equity plans, practices to close access, progression, completion and attainment gaps.

Enrollment of all qualified students attending partner community colleges is encouraged but the program places emphasis on the recruitment and retention of Illinois residents from historically underrepresented race and ethnic groups, women, individuals from low-income and/or first-generation households, and veterans. Fifty-three students are expected to transfer through Pathways in the Fall 2022 cohort, 64% of which are considered underrepresented in engineering: 26% underrepresented racial/ethnic minority, 13% women, 4% veteran, 21% first-generation student or low socioeconomic status. Recruitment efforts for transfer programs include online information sessions, student meet and greets, mailing campaigns, and on-site recruitment hosted in the evenings for K-12 students and families to attend.

Once enrolled, we have developed a robust system to aid in monitoring and retaining students. In addition to the MEP, WIE, and ARISE programs mentioned above, the Grainger College maintains the Center for Academic Resources in Engineering (CARE), which is available to all Grainger students, to enhance the learning experience through academic support, to set up collaborative learning opportunities, and to provide positive influence through peer mentoring and tutoring. Furthermore, the Department of Nuclear, Plasma, and Radiological Engineering actively monitors students' progress throughout the semester and proactively reaches out to students who are struggling. The Department Chief Advisor leads this effort, and also is available for advising appointments for all students. The Department Associate Head of Undergraduate Programs works with instructors to identify and appropriately act on concerns they may have regarding students. Mental health services are readily available to our students including an embedded counselor with the Grainger College of Engineering and Concern for student website maintained by the Dean of Students office; a student can be easily referred to either of these resources by a concerned faculty member or advisor. This broad and multi-layered outreach approach helps ensure that all of our students are supported administratively, academically, and emotionally. Through monitoring with early interventions and course corrections when needed, this system allows us to ensure overall student well being and progress towards degree completion.

Describe program and institution-based high-impact practices and wrap-around student support services ensuring equitable access and success for students enrolled in the proposed program.

Institution-level high-impact and wraparound support services

Access 2030 demonstrates the University of Illinois' commitment to supporting "the ongoing learning renewal of students and systemic implementation of evidence-informed student support practices." This equity-focused plan includes emphasis on the

three universities' summer bridge programs, proactive advising, and high-impact practices to support retention and to ensure equitable access and success.

In addition to Access 2030, the System supports students through the President's Research in Diversity Travel Assistance award. This competitive program, primarily for graduate students, has been established for the purpose of promoting diversity and the understanding of diversity within the University. Recipients are provided a certificate and funding up to \$600 to travel to a professional conference related to diversity or identity (such as those conferences involving race, gender, ethnicity, sexual orientation, disability, and national origin) to present papers, posters, or creative work in service to the University's interest in a diverse learning community.

At the institution level, the University of Illinois Urbana-Champaign prides itself on the array of high-impact practices and services offered to students. These student support practices support the ongoing learning renewal of students and systemic implementation of evidence-informed student practices, which align with Equity Strategy 1 of A Thriving Illinois. The Counseling Center, Office of the Dean of Students, McKinley Health Center, and Student Assistance Center are accessible to all students via in-person or remote options to facilitate student wellness and retention. All students are encouraged to participate in workshops hosted by the university's Writer's Workshop and are eligible to receive assistance on writing projects through their writing assistants. For students with disabilities, Disability Resources & Educational Services (DRES) has helped thousands of students earn college degrees and Urbana-Champaign has been recognized as a national leader in the area of post-secondary education for persons with disabilities. Indeed, as the oldest post-secondary disability support program in the world, DRES has been associated with many programmatic innovations including:

- The seminal research which led to the development of the first architectural accessibility standards that would become the American National Standards Institute Standards;
- The first wheelchair-accessible fixed route bus system;
- The first accessible university residence halls;
- The first university service fraternity and advocacy group comprised of students with disabilities, Delta Sigma Omicron; and
- The first university to receive the Barrier-Free America Award from the Paralyzed Veterans of America (2012).

Additionally, poised at the crossroads of academic and student affairs, the Office of Minority Student Affairs (OMSA) is one of the oldest and most comprehensive student support programs in the nation. The OMSA has embodied the University of Illinois Urbana-Champaign's land-grant mission by championing access for all students and providing a comprehensive array of college preparatory and support services to bolster students' success since its inception. Programs such as AMPS (Academic Mentoring, Programs, and Services) through OMSA also align with A Thriving Illinois Equity Strategy 8 with the use of near-peer mentoring and staff as mentors/coaches. OMSA currently houses six departments. A more comprehensive list of OMSA programs is provided in Appendix B.

The Office of Student Affairs, particularly through their Office of Inclusion and Intercultural Relations (OIIR), supports numerous programs aimed at supporting diverse groups of students including working adults, students of color, and transfer and low-income students (just a sampling of which are provided in this document. OIIR houses UIUC's cultural and resource centers and a variety of high-impact programs; to name just three examples: 100 STRONG Program, I-Connect Diversity & Inclusion Workshops, and Housing Division Social Justice and Leadership Education. A more comprehensive list of programs and more specifically programming, support, and services geared toward African American students, Latino/a students. Veteran support is provided through the Chez Veterans Center out of our College of Applied Health Sciences, which includes individualized academic and career coaching to support progress and address barriers, peer and professional mentoring to foster community and networking, and health and wellness services to promote psychosocial adjustments and well-being.

The Career Center offers coaching and support students and connects them to opportunities, as they make career decisions and learns lifelong career management skills. They serve as leaders of the UIUC career services community. The Career Center sponsors the FOCUS program, an intensive year-long program created to eliminate the gap in post-graduation outcomes and starting salaries between underrepresented, first-generation students and their peers. Its aim is to positively impact their career trajectory, earnings potential, and economic security for years to come. Through a series of workshops, this program provides transformative learning experiences for students in and out of the classroom. Those selected to participate receive a \$2,500 scholarship over two semesters.

Finally, the university continues to develop and grow the Illinois Scholars Program (ISP). Designed to serve residents of the state of Illinois from historically underserved populations and low-sending counties, ISP guides undergraduate students' transition to the University of Illinois Urbana-Champaign by providing a wide range of educational, personal, social, and cultural opportunities. ISP aims to combine opportunity and access, experiential learning, and support to position students for academic success and personal growth throughout their time at Illinois. ISP begins with a four-week intensive summer bridge experience for incoming first-year students, and ISP continues to provide support and community for Illinois Scholars during their undergraduate years. Since the program's inception, 106 students have completed their summer bridge experience, with a 93.9% retention rate from their freshman to sophomore years, compared to a 91.5% campus retention rate for underrepresented minority students during the same period.

College, department, and program-level high-impact and wraparound support services

Mentoring and Advising Programs. The Grainger College of Engineering prides itself on its well-established organizations and supports to help promote a sense of identity and belonging for students. Student chapters of prominent national organizations have been in existence for decades with the goals of connecting students to student support services, professional organizations, and the community. More specifically, through the Women in Engineering (WIE) program, women students are invited and encouraged to form connections in community with other women as well as the overall student

form connections in community with other women as well as the overall student population. At the recruitment stage, women students are recruited strategically through mailings that feature handwritten notes from women students in the admitted student's major. Admitted students and parents are invited to luncheons and meet-and-greets to learn more about each engineering major, the successes and experiences of current students, and how the specific admitted student's experiences and interests can be leveraged and pursued toward their success at Illinois. Transitioning to campus life, women students are invited to the WIE First-Year Orientation, in which staff from the Center for Academic Resources in Engineering (CARE), faculty and staff from academic departments, and other resources speak directly to women students. Through this experience, they form critical first connections with other first-year students, upper-class students, and college faculty and staff. Current women students are supported academically, socially, and professionally toward their success through the following avenues: monthly Newsletters highlighting successful alumnae (especially women of color) and noting relevant scholarship and professional development activities, social engagement events, and celebrations (birthdays and Deans List). Through these recruiting and support activities, the college fosters an inclusive community of belonging for women students.

The Morrill Engineering Program (MEP) fosters a community of students of different levels that promotes peer networking and mentoring. Throughout the term, MEP communicates with students via newsletters and individual contacts. Through the SOS (System of Success) Retreats held each semester, MEP staff and alumni develop and implement workshops that provide guidance and insight to professional and personal development, often pointing to campus services that were useful to them when they were students. Alumni are also involved in the ENG 111 course by providing keynote addresses as role models and endorse students for opportunities within their organizations. Efforts such as WIE, CARE, MEP, and ENG 111 align with A Thriving Illinois Equity Strategy 1 in that they provide proactive and comprehensive advising and involve learning communities – a high-impact practice. They also align with Equity Strategy 8 through their near-peer mentoring and use of staff and alumni as mentors/coaches.

MEP supports and influences student chapters of nationally affiliated professional organizations that support underrepresented minorities in STEM. Through these organizations including the National Society of Black Engineers (NSBE), the American Indian Science and Engineering Society (AISES), and the Society of Hispanic Professional Engineers (SHPE), MEP informs and promotes engagement of academic and professional development opportunities on campus. Each organization holds regional and national conventions that bring together collegiate and professional members throughout the United States. These conventions provide the opportunity for students to present academic research, engage in professional development workshops, and participate in career fairs. These conventions promote engagement with other professional organizations related to specific areas of engineering and serve as a source of motivation and belonging to students. Through gift funding, MEP and ARISE (Academic Redshirt in Science and Engineering) provide financial support to supplement departmental support of students who wish to attend professional development conferences.

Internships. Engineering Career Services (ECS) hosts several opportunities for students to engage in internship exploration and experiences.

ECS offers walk-in and scheduled advising opportunities for students to discuss their internship, job shadow, and co-op searches. Nuclear, Plasma, and Radiological Engineering advises students each term to also meet with ECS to discuss their resume, internship search, and graduate or medical school preparation process alongside meeting with bioengineering department academic advisors. A co-curricular opportunity search engine, Handshake, is also available to all Illinois students, including students in the Environmental Engineering program. Nuclear, Plasma, and Radiological Engineering will work one-on-one with underrepresented students via department academic advising to ensure underrepresented students are comfortable accessing and navigating the platform and have a clear understanding of how to set search and notification parameters for opportunities relevant to their interests and major.

Engineering 100 (ENG 100), required of all Grainger Engineering students, also incorporates advising for professional development, including internship searches and resume preparation. Prior to the fall career fair, all engineering first year students are required to submit resumes as an assignment in ENG 100, which are then reviewed by their course instructor. Course instructors provide feedback to students in order to prepare them for the career fair, where they will meet several employers and begin the experience of networking and sharing their interests with industry contacts. ECS also offers the opportunity for students to participate in wEtrek, which is a program designed for first and second-year students to explore different industries via in-person and virtual job shadow days with our industry partners.

All of these efforts are tracked by program staff and usage statistics are collected via Engineering Career Services and reported to the Associate Dean of Undergraduate Programs in Engineering; statistics are broken out by demographics, including race/ethnicity, gender, first-generation status, and major. An annual review of this data informs the College's efforts and services, allowing them to tailor presentations and recruitment efforts to engage underrepresented populations via targeted information sessions, presentations in courses underrepresented students enroll in through the WIE, ARISE, and MEP programs. Ultimately, student placement data upon graduation is collected under the Illini Success survey, a campus-wide effort supported by the Provost's office to collect graduation data outcomes beginning in August 2014. Additionally, the College of Engineering hosts two career fairs per year.

Explain institutional strategies being implemented to increase and retain faculty, staff, and administrators of color and the implications for the proposed program. Explain how progress will be monitored.

Aligned with Equity Strategy 3 (Implement equitable talent management to increase and retain faculty, staff, administrators, and trustees of color), the UI System and the UIUC Campus support efforts in this area, particularly in supporting underrepresented minority faculty. The Distinguished Faculty Recruitment Program has a stated goal of increasing underrepresented minority faculty. Since 2017, the System has committed \$20 million to this program, the recruitment of tenured, star, or rising faculty from a

range of disciplines who can transform our universities by their exceptional scholarship and teaching. One criterion is that the faculty member “will enhance diversity in the unit and in the college.” The Public Voices Fellowship is a year-long program open to tenured faculty to join a cohort of leaders, the majority of whom will be underrepresented (including women) and provide them with extraordinary support, leadership skills, and knowledge to ensure their ideas shape not only their fields, but also the greater public conversations of our age. The Leadership Initiative for Women Faculty brings together women faculty from across the UI System who are leaders and/or potential leaders to identify barriers to and facilitators for advancement of women. Finally, the System will also be providing funding in support of each university’s faculty recruitment plans which will also emphasize the recruitment of underrepresented minority faculty.

As a campus, the University of Illinois Urbana-Champaign is committed to investing in strategic hiring of faculty to maintain our academic strengths, respond to student demand, and capture opportunities. Investments from the Office of the Provost in faculty hiring, retention, and development are critical to maintaining and enhancing the academic excellence of our campus, especially at a time when the competition for top talent is intense. The Next 150 strategic plan identified a major hiring initiative to expand faculty hiring in key areas over the next five years, with the goal of expanding the overall size of the faculty. While the COVID-19 pandemic slowed that initiative, the University remains committed to hiring with the goals of enhancing faculty diversity and meeting student demand.

Though all faculty hiring is a department and college-level decision, the campus has devoted significant resources to incentivize hiring activities that support diversity, recruitment, and retention goals. Prominent among those programs are the Targets of Opportunity Program (TOP) and the Dual Career Academic Couples (DCAC) program. The TOP program provides recurring funds for salary support for hires that enhance campus diversity, including faculty from underrepresented groups and women in STEM fields. Nearly all of these hires are identified through a traditional search process. The Provost invests ~\$1 million per year in this recurring salary support for TOP. The Office of the Provost, in conjunction with the Office of the Vice Chancellor for Diversity, Equity, and Inclusion also announced a temporary modification to the TOP program to recruit more faculty of color. This initiative made an additional ~\$1 million available to units to support hiring in this area. For the DCAC program, the Provost provides recurring matching funds (i.e., 1/3 of the initial salary) if the partner is hired into a tenure track position through the DCAC program. Several years ago, the Provost modified the DCAC program to provide only non-recurring funding (1-3 years) for non-tenure track partner hires which has helped to reduce the overall cost of the program.

The campus also continues to fund postdoctoral fellowships targeted to underrepresented scholars in ethnic studies programs (e.g., Latina/Latino Studies, American Indian Studies, etc.) and through the DRIVE program. These programs are intended to help provide postdocs with an opportunity to build a foundation of scholarship that will prepare them for tenure track positions. While the ethnic studies postdocs are selected through a specific advertisement, the DRIVE program identifies candidates through a search process for open faculty positions.

Finally, through a partnership with the University System Office and departments, the Provost's Office also supports the Underrepresented Faculty Recruitment Program in making available non-recurring funds for research to enhance offers of employment. Awards up to \$20,000 per year for each of the first three years of employment are available for those hired in the 2022-2023 academic year. The Provost's Office funds the additional search expenses incurred by bringing an additional candidate to campus if that person is from an underrepresented group.

Additional retention efforts include programming and development activities for executive officers and faculty members across ranks. Programming and resources for unit executive officers (EOs) equip them with the knowledge and skills necessary for leadership including ways to enhance their ability to support and mentor faculty within their units, particularly faculty members of color. The Office of the Provost also coordinates several leadership development programs to increase the pool of potential academic leaders on campus with intentional focus on supporting faculty members from marginalized and underrepresented groups to explore campus leadership and administrative roles.

The Office of the Provost also invests in faculty development. From recruitment to onboarding, through promotion, and retirement, faculty members have access to programming and resources designed to meet them and address their careers needs. The office also supports several institutional memberships that provide external resources to our faculty, such as the National Center for Faculty Development and Diversity to ensure faculty members' continued access to NCFDD's resources.

To monitor progress of our efforts to recruit and retain faculty members of color on our campus, we collect, manage, and report annual data through the Division of Management Information and Office for Access and Equity. Additionally, we release a yearly report on hiring and retention of women faculty of color through the Women at Illinois report (e.g., 2020-2021 report and 2021-2022 report).

College, department, and program-level efforts to recruit and retain faculty, staff, and administrators of color

College, department, and program-level efforts to recruit and retain faculty, staff, and administrators of color.

The Grainger College of Engineering and Department of Nuclear, Plasma, and Radiological Engineering offer many resources to support and retain faculty. Examples of these at the college level include the Collins Scholars Program for new engineering faculty, which exists to help faculty get their careers off to an efficient and productive start. The program provides a culture of support for teaching, research, and service in a relaxing and collegial environment. The Collins Scholars meet every Friday to discuss instructional design, research-based teaching strategies, and innovative assessment techniques. Staff and distinguished guests from around campus, lead the weekly interactive seminars. Collins Scholars also visit the classrooms of excellent teachers and are observed at least once during the academic year. Another college-level example is the Strategic Instructional Innovation Program (SIIP). SIIP awards education-innovation grants to faculty teams using a model similar to research-grant funding. The motivating vision for education innovation is to teach like we do research,

meaning that teaching can and should involve collaboration, creativity, excitement, measurement, perseverance, and continual improvement, as do high-quality research programs at Illinois. SIIP has achieved marked success by bringing aspects of Illinois' outstanding research culture to teaching, including an engaged community, collaborative projects, faculty-led innovation, rigorous evaluation, and a scholarly approach to pedagogical methods. The college also designates faculty members as Education Innovation Fellows (EIF's) and Entrepreneurial Mindset Fellows (EMF's). EIFs and EMFs have a connecting role in the College. They interact with staff, departmental colleagues, and others across the College involved in educational innovation to share and unify educational efforts. They also have an innovating role. They identify and

## Sustainability



Describe strategies and initiatives the institution plans to implement that makes the proposed program and college more generally affordable for students and their families, including those who have been historically underserved.

#### Institution-level affordability plans

The University of Illinois and the University of Illinois System have been committed to implementing strategies to make college “more affordable, particularly those who have been historically underserved.” The following initiatives have been implemented and promising outcomes have already been realized. The President’s Award Program (PAP) and PAP Honors provide financial support for students admitted to one of the UI Systems three institutions from historically underrepresented groups. The PAP award is \$5,000 per year available for a maximum of four years while PAP Honors awards \$10,000 per year for four years. Over \$244 million has been distributed between 2006 and 2020.

The University participates in the State of Illinois AIM HIGH Grant program, which provides \$5,000 per year (\$20,000 over four years) in merit-based awards to the top academically admitted new freshmen who meet eligibility requirements.

Aligned with A Thriving Illinois’ Equity Strategy 5 and Growth Strategy 4 to encourage high school graduates to enroll in our higher education system and keep talent in Illinois, Illinois recently adopted the Common App.

Recognizing the barrier that affordability creates to higher education, the University of Illinois Urbana-Champaign has taken action to increase the portfolio of financial support for students. The university annually provides over \$465 million in financial aid funding to undergraduate students, with 72% of students receiving some type of aid. Over \$145 million of that funding comes from institutional sources, with the vast majority provided to Illinois residents as need-based grants and scholarships. The university has two signature financial aid programs. Began in 2005, the Illinois Promise program covers tuition, campus fees, room/board, and books/supplies through a combination of federal, state, and institutional grants and a \$2,500 Federal Work-Study award to Illinois residents whose family income is at or below the federal poverty level. In 2019, the Illinois Commitment program began and provides a combination of federal, state, and institutional grants to cover tuition and campus fees for Illinois residents whose family income is \$67,100 or less. Approximately 30% of Illinois residents attending UIUC receive funding through either the Illinois Promise or Illinois Commitment programs. Of the 2020-2021 cohort of Illinois Commitment recipients, 36% identify as Hispanic, 28% as White, 19% as Black/African American, 14% as Asian, and 3% identify as two or more races.

In an effort to acknowledge financial constraints that may impact retention, in March 2020, the University of Illinois Urbana-Champaign raised the threshold that previously prevented course registration due to holds placed on student accounts resulting past-due balances of over \$200. The change now only impacts students whose past-due balance is over \$1,500. This proactive institutional response is an example of alignment with the Sustainability Goal, Strategy 3 of A Thriving Illinois.

## College, department and program affordability plans

The Grainger College of Engineering and Department of Nuclear, Plasma, and Radiological Engineering offset tuition costs through scholarship incentives, especially for incoming first-year students. Both the Grainger College and NPRE Department are fortunate to have significant amounts of funds provided by generous donors for this purpose. The Grainger College and NPRE Department distribute the scholarships to recruit the best and brightest students nationally. But within that select group of candidates, the College and Department traditionally further deploy the funds to incentivize the recruitment of women, traditionally under-represented student populations, and first-generation students. The Department's efforts to make higher education more affordable for historically underserved students is clear, and will continue on in future years.

Provide tuition cost analysis for comparable programs and institutions in Illinois.

As stated previously, the Nuclear, Plasma, and Radiological Engineering + Data Science BS program will currently be the only such like program in the State of Illinois. No other Nuclear Engineering program exists in the State and the combination with Data Science will indeed continue to make it even more unique. However as a point of reference examples are given from three institutions in the state that offer related bachelor in Data Science programs, all of them private schools. The following tuition costs are estimated. These estimates place tuition for the proposed program at the lower spectrum of cost.

Institution: Dominican University, BS in Data Science

Estimated Tuition: \$35,850 per academic year

Source: Undergraduate; Rosary College of Arts and Sciences; 2022-2023

<https://www.dom.edu/admission/office-financial-aid/student-accounts/tuition-fees-and-expenses>

Institution: Olivet Nazarene University, BS in Data Science

Estimated Tuition: \$36,950 per academic year

Source: Undergraduate; 2022-2023

<https://www.olivet.edu/financial-aid-college-cost-calculator>

Institution: Lake Forest College, BA DS - Finance & Economics

Estimated Tuition: \$52,000 per academic year

Source: Undergraduate; 2022-2023

<https://www.lakeforest.edu/academics/college-catalog/tuition-and-fees>

### PROPOSED:

Institution: University of Illinois Urbana-Champaign, B.S. in Nuclear, Plasma, and Radiological Engineering + Data Science

Estimated Tuition: \$17,660 (resident), 38,132 (nonresident), 41,110 (international)

per academic year

Source: Undergraduate; Grainger Engineering; Fall 2022 entry term

<https://registrar.illinois.edu/ug-tuition-rates-2223/>

## Growth

Provide a supply and demand analysis for the proposed program that, at minimum, does the following: a) Provides evidence of student interest in the proposed program including any strategies to incentivize students to stay in Illinois. b) Identifies and provides evidence of a high-quality credential with viability for future careers.

#### a) Incentives for Student in the Program

There are at least three groups of students that can be identified who have shown interest in a potential degree of this kind (NPRE+DS). First is the group of students who enter the current NPRE degree program, but are drawn by the higher demand (and possibly higher salaries) of fields such as data analysis and computer science. Despite their interest in NPRE, some of these students transfer out of our current BS in NPRE degree program. Second is the set of students who are currently in the BS in Computer Science degree program, but are interested in a more “sciency and physicsy” degree program. (They cannot imagine themselves writing C++ code all their lives.) This group of student were interested in core STEM fields of math and physics in high school, and would like to continue at the interface of data science aspects of a computer science degree and the math and physics of a more applied engineering field, such as NPRE. We have had students who transferred from the BS in CS degree program to join the BS in NPRE degree program. If a BS in NPRE+DS degree exists, we can imagine a higher number of students are likely to stay in the College, by simply switching to the BS in NPRE+DS degree program. Third group consists of the very large number of high school students who apply to pursue the BS in CS degree program, and are not admitted in that degree program because of stiff competition and limited number of slots. Many of these students are similar to the students in the second group, in that they would prefer a degree program at the interface, but none currently exists. This is the largest group of students we expect to enter the NPRE+DS degree program.

As University of Illinois application system allows high school students two choices for degree programs, we expect a significant number of students selecting NPRE+DS as their second degree option.

Illinois is the most nuclear state in the country with more nuclear power plants than any other state. Evidence from student exit surveys suggests that in-state students are more likely to stay and become employed in Illinois within the first few years after graduation. A large number of our graduates are employed by this industry in the state of Illinois. It is also evident that in-state students are more likely to stay in Illinois after graduation. Providing new skill sets to these students in a field with high demand and high financial rewards within the state of Illinois is likely to help retain these graduates in the state. New initiatives such as Discovery Partner Institute (DPI) will also lead to new demands and opportunities for students with skills at the interface of a STEM field and data science.

Thus, the Department of NPRE aims to continue the successful recruitment and retention of in-state Illinois students with the NPRE+DS program. Furthermore, the Department intends to continue historically strong recruitment and retention of transfer students from Illinois community colleges, as exemplified by the Pathways program. To strengthen connections to the nuclear, power and radiological engineering industry

within Illinois, the alumni advisory board will continue to include and even to expand nuclear engineering representatives from within the state of Illinois. The advisory board will meet regularly to provide review input to the program regarding curricular matters as well as job need and placement strategies for the state of Illinois.

It has been widely demonstrated that students' attitudes about the engineering field are strongly linked to their retention [1-3]. In a study of student persistence in engineering, White et al. found that how students felt while participating in STEM courses and after completing STEM assignments was a strong predictor of STEM persistence [4]. The authors further suggest that these feelings are grounded in intrinsic motivation based on their interest in a given activity [4]. Therefore, the development of course materials that peak student interest offers a low-risk opportunity to increase retention in engineering across all student populations.

[1] Besterfield-Sacre, M.; Atman, C. J.; Shuman, L. J., Characteristics of freshman engineering students: Models for determining student attrition in engineering. *Journal of Engineering Education* 1997, 86, (2), 139-149.

[2] Russell, M. L.; Atwater, M. M., Traveling the road to success: A discourse on persistence throughout the science pipeline with African American students at a predominantly white institution. *Journal of Research in Science Teaching* 2005, 42, (6), 691-715.

[3] French, B. F.; Immekus, J. C.; Oakes, W. C., An examination of indicators of engineering students' success and persistence. *Journal of Engineering Education* 2005, 94, (4), 419-425.

[4] White, J. L.; Altschuld, J. W.; Lee, Y. F., Persistence of interest in science, technology, engineering, and mathematics: A minority retention study. *Journal of Women and Minorities in Science and Engineering* 2006, 12, (1), 47-64.

#### b) Department/Program Evidence of a High-Quality Credential with Viable Future Careers

The proposed NPRE+DS B.S. program will support (i) educational attainment, (ii) high quality credentials to meet economic demand, and (iii) integration of educational, research and innovation assets. The degree program will provide students with high quality credentials enabling them to enter the workforce. Further, the development of the NPRE+DS B.S. program will leverage the University's research and innovation assets to advance education through an integrated portfolio.

Students receiving a B.S. degree in NPRE+DS will be uniquely trained in the core areas served by the traditional nuclear, plasma and radiological engineering degree as well as the newly emerging field of data science and data analytics. Data Science is a rapidly growing field with demand far surpassing the supply. As mentioned elsewhere, Office of Labor Statistics predicts the growth in data science jobs to be far higher than average. Starting salary for data science graduates is also higher than average engineering graduate. Linking data science expertise with that of a specific discipline (in this case, NPRE) makes the degree very appealing for those who have interest in the discipline of nuclear, plasma and radiological engineering, but also are interested in computational sciences and data analysis. and want to improve their job and growth prospects by

adding to their portfolio a field that is growing rapidly. Studies and market analyses were conducted at the campus level to assess the viability of X+DS degrees (reported elsewhere in this report), and concluded that there is and will remain for foreseeable future, demand for such degrees. As for the specific NPRE+DS degree, we have sought input from our alumni board and from alums in general, and there is strong (though anecdotal) demand for nuclear, plasma, and radiological engineers who have proficiency in data analysis and data analytics. As one alum mentioned (paraphrasing), “we currently hire consulting firms for even small data analytics needs; having our own engineers with those skill sets will improve our operations significantly”.

Explain how the program engaged with business and industry in its development and how it will spur the state’s economy by leveraging partnerships with local, regional, and state industry, business leaders and employers.

### Institutional engagement

The University of Illinois Urbana-Champaign has strong partnerships with business and industry through the statewide initiatives like the Discovery Partners Institute (DPI) and the Illinois Innovation Network (IIN), which closely align with A Thriving Illinois’ Growth Strategies. As a key gubernatorial initiative, DPI’s Tech Talent Lab and immersion programs engage with Chicago’s technology workforce, allowing students to interact with Chicagoland technology and innovation culture. Students make meaningful connections to regional employers and industries, university research teams, civic and nonprofit organizations, and startups that will lead to employment and talent retention in the region. IIN works to enrich the student experience through short-term boot camps around topics such as artificial intelligence, data science, entrepreneurship, and more. These intensive programs will encourage students’ interest in topics that are key to the 21st century economy and give them a foundation for continued study.

Partnerships with the Research Park, the work of the Campus Community Compact, and PK-12 programming overseen by the Associate Chancellor for PK-12 Initiatives align with A Thriving Illinois’ Growth Strategies.

As a crucial hub that provides meaningful and industry-focused research and internship opportunities, the Research Park employs 800 interns year-round in part-time employment, allowing University of Illinois Urbana-Champaign undergraduate and graduate students to work on campus and be enrolled as full-time students. There are more students working at the UIUC Research Park than at any other peer United States university research/tech park. Students are paid highly competitive wages for their specialized skillsets in areas like data analytics, engineering, and business development. A number of these interns are classified as Federal Work-Study. Research Park internships increase students’ employment prospects by expanding their professional networks, building their professional portfolios, and developing their leadership skills. Many of the corporate sites focus on DEI outreach and participate as sponsors to various student groups and campus units. Examples include Synchrony’s sponsorship of FOCUS Scholars. Building on the well-established relationships of the affinity and community groups both on campus, the Research Park campus office has ongoing partnerships with units like La Casa Cultural Latina, the Bruce Nesbitt African

American Cultural Center, and The Career Center, as well as student groups such as the Society of Women Engineers, Alpha Omega Epsilon (professional women's leadership sorority), and Sigma Alpha (professional agricultural sorority), to educate Illinois' diverse population of students on the opportunities available within the Park. The Illinois Reboot tech training program provides a free course in data science literacy to Central Illinois professionals who are underrepresented in technology and looking to upskill their careers. Since its inception in 2020, Reboot has trained 150 community members, 61 percent from underrepresented populations. Reboot also provides career coaching and access to Research Park data science professionals. Accelerating Women And underrepresented Entrepreneurs (AWARE), programmed through the EnterpriseWorks incubator at the Research Park, supports entrepreneurship training, counseling, and networking for women and underrepresented entrepreneurs.

Another local program, We CU, connects student volunteers with community projects. This program empowers students to make a positive impact in the community while building their resume and enriching their university experience. By joining, students become part of a diverse group of peers passionate about serving the community. In the first two years of the program (2020-2022), 1,973 UIUC students from 12 colleges worked to complete almost 37,000 hours of training and service on 516 service projects.

The Campus-Community Compact (Compact) is one of the major initiatives of the Community Action and Public Engagement (CAPE) Committee of UIUC's Chancellor's Call to Action to Address Racism and Social Injustice. Comprised of a co-equal partnership between UIUC and the broader Champaign-Urbana community, the Compact is an ambitious and visionary initiative to accelerate social justice by addressing structural racism, bias, and social injustice over the next 5-10 years in six interrelated grand challenge areas: inclusive education; accessible technology; economic development; health, wellness, and resilience; workforce development; and community relations. The Compact also includes several crosscut areas; namely, accessible campus/transportation, accessible information, community safety, and language (e.g., multilingualism, communications, and messaging).

#### College, department, and program engagement

Through Career & Professional Development, Engineering Career Services bridges college and community relations by delivering relevant career exploration, development, and recruitment services to all students in the college. Engineering Career Services builds and maintains industry relationships through strategic engagement and intentional outreach and collaboration, such as:

- DEI and Honors Networking events held for James Scholars and Women in Engineering programs.
- Career Fairs: Virtual and In-Person career fairs are offered at the start of fall and spring semesters serving hundreds of employers and thousands of students (BS, MS, PhD and alumni)
- Major Meet-Ups: Opportunities for students to meet with employers seeking specific majors
- Handshake: featuring thousands of companies, jobs and events
- Career Exploration & Search Workshops and Courses: workshops & training events

offered each semester, in-person and virtually, partnering with WIE, ARISE, and MEP

- Student Newsletters & Social Media targeted to engage underrepresented groups
- Student & Employer Website and Virtual Career Technologies (JobScan, FirstHand/Vault, Campus Groups, BuzzFile, Parker Dewey, YouTube videos, etc. See website for complete list. <https://students.grainger.illinois.edu/ecs/tools-and-resources/>
- Grainger Engineering Link Mentoring Program: Mentoring program managed through the People Grove platform

In addition to the opportunities provided through Engineering Career Services, all Grainger Engineering students have access to coursework and programming provided by the Technology Entrepreneur Center (TEC). These include affiliations with the statewide Illinois Innovation Network and activities supported by the Discovery Partners Institute to strengthen regional focus and state connections, which aligns with Growth Strategy 1 of A Thriving Illinois.

At the Department level, several actions to connect with Illinois industry where NPRE+DS graduates are likely to be employed will be undertaken. The Department of NPRE plans to revamp the departmental alumni advisory board (Constituent Alumni and Industry Advisory Board, CAIAB) to include representative alums who have encouraged us to develop the NPRE+DS degree. The advisory board meets regularly to provide review input to the program regarding curricular matters as well as job needs and placement strategies for the state of Illinois. Also, the Department will extend its NPRE 199 Undergraduate Seminar invited speakers to include specific content for students in the NPRE+DS program. The NPRE 199 Undergraduate Seminar comprises a

Describe how the proposed program will expand access and opportunities for students through high-impact practices including research opportunities, internships, apprenticeships, career pathways, and other field experiences.

Institution level high-impact practices

The University Research Park expands access and opportunities for students by employing 800 interns year-round in part-time research opportunities and career-relevant internships, allowing University of Illinois Urbana-Champaign undergraduate and graduate students to work on campus and be enrolled as full-time students.

The Office of Undergraduate Research (OUR) is guided by the philosophy that all Illinois undergraduate students should learn about current disciplinary research, take part in research discussions, and be exposed to research experiences in their regular coursework. Furthermore, where practical, an advanced research experience should be among the capstone options in all major programs of study. Undergraduate research opportunities should be designed to support the pedagogical goals and the research mission of the university. To achieve its mission, OUR seeks to: 1) inspire students and faculty to collaborate on research projects driven by mutual interests by fostering a research mentoring environment that encourages and rewards collaboration; 2) disseminate best practices and models for undergraduate research to campus stakeholders; 3) assist in the development and evaluation of curricular and co-curricular structures that support undergraduate research; 4) encourage the creation of new opportunities for undergraduate research on campus and 5) coordinate and



Explain how the proposed program will expand its models of teaching and learning, research, and/or public service and outreach that provide opportunity for students to succeed in the work of the future.

The NPRE department has an active Curriculum Committee that works to review and improve courses and teaching practices by considering new developments and best practices. Most recently this committee developed and then implemented a significantly revised curriculum for the NPRE BS degree. The revised degree plan is more responsive of the industry and societal needs. This Committee will expand its focus to do the same for the NPRE+DS degree program once that becomes available. This committee will also work closely for the NPRE+DS degree program, with the corresponding committees in the other departments that are part of this new degree. Needs of the domain specific industry will be communicated to the sister committees, and then modifications and expansion of the curriculum will take place collaboratively.

Because of the specific focus on data science, graduates of the new degree program will be better equipped to address issues such as environmental justice and energy justice, that require a broader understanding of large data sets.

The Department has earned ABET accreditation for its NPRE degree. The department is prepared and well positioned to earn ABET accreditation for the NPRE+DS degree once it is eligible to do so. In order to earn ABET accreditation, a program must demonstrate suitable satisfaction of pre-set learning outcomes that consider both technical competencies as well as development of broader skills and ethics. The next scheduled ABET evaluation will occur in 2025.

Beyond workforce need, describe how the program broadly addresses societal needs (e.g., cultural or liberal arts contribution, lifelong learning of Illinois residents, or civic participation).

Environmental and social justice in the context of energy and its consumption has become critically important. Typical engineers are usually not equipped to address the data analysis needs when working on these topics. They often need to work in a team with other data scientists. Graduates from the proposed NPRE+DS degree program will be much better equipped to address the challenges of environmental and social justice in the context of energy. By appropriate selection of their general education requirement, these NPRE+DS degree graduates may even be able to address the social science context of these issues.

This novel degree program, and the strengthened relationships across campus that will result, will transform the educational experience of our students and put them in a position to directly serve society through the beneficial impact described above.

Additionally, the program is expected to be of greater interest (relative to the broad range of disciplines covered by NPRE and most other engineering disciplines) to female and underrepresented minority students, which will help the Grainger College of Engineering to increase their representation in the student body. Further, this degree program will contribute to the Illinois State Board of Education initiatives to provide all students with “educational opportunities to pursue high-wage, high-skill, in-demand occupations leading to economic self-sufficiency”.

## Program Description and Requirements

### Illinois Administrative Code:

*1050.30(b)(1) A) The caliber and content to the curriculum assure that the objectives of the unit of instruction will be achieved; B) The breadth and depth of the curriculum are consistent with what the title of the unit of instruction implies; C) The admission and graduation requirements for the unit of instruction are consistent with the stated objectives of the unit of instruction.*

*1050.30(b)(3): Appropriate steps shall be taken to assure that professional accreditation needed for licensure or entry into a profession as specified in the objectives of the unit of instruction is maintained or will be granted in a reasonable period of time.*

*1050.50 (a)(2)(C) Requirement for Programs in which State Licensure is Required for Employment in the Field: In the case of a program in which State licensure is required for employment in the field, a program can be found to be in good standing if the institution is able to provide evidence that program graduates are eligible to take the appropriate licensure examination and pass rates are maintained as specified in the objectives of the unit of instruction. If there is no such evidence, the institution shall report the program as flagged for review.*

## Program Description

Provide a description of the proposed program and its curriculum, including a list of the required core courses and short ("catalog") descriptions of each one. (This list should identify all courses newly developed for the program).

Provide Program Description here:

Nuclear, plasma, and radiological engineering encompasses a broad and diverse but complimentary set of engineering disciplines with a wide variety of applications that are vital to society – in energy production, plasma processing of materials, fusion development, biomedical research and healthcare, and nuclear safeguards and radiation detection. The areas of study and research in Nuclear, Plasma, and Radiological Engineering increasingly involve modeling, simulation, numerical analysis, and the use of computational methods - practices which produce a large quantity of data. Being able to gather, organize, interpret and analyze the data that is produced from these efforts is an increasingly in demand skill set. Establishing and following best practices of data stewardship is also of utmost importance for ethical usage. The Nuclear, Plasma, and Radiological + Data Science BS program recognizes the interdisciplinary importance and benefits of combining data science with the domain specific NPRE discipline. It adds breadth in the direction of data science literacy and competency. A related outcome is to promote data science in the NPRE discipline and as a result increase competitiveness with widening opportunities for our graduates as they enter a data driven economy.

In line with the current practice for the existing Nuclear, Plasma, and Radiological Engineering program, all classes, laboratories, and discussion sessions associated with the NPRE + DS program will be held in the face-to-face instructional format. If and when conditions dictate that it be necessary, however, the Department can modify any class to a hybrid or full on-line learning format. This degree program is expected to be completed in eight semesters of full-time studies and will be offered by the NPRE Department in the Grainger College of Engineering (GCOE). The proposed program will be distinguished by attributes that are currently not available together in any individual degree program in the UI System, in the state of Illinois, or in the nation, including focus on i) continued safe and reliable nuclear energy production which relies on multifaceted engineering disciplines for design and analysis of large complex systems, ii) plasma processing for a myriad of applications including semiconductor production and harnessing the power of nuclear fusion, iii) the intersection of radiation technologies, medicine, and security. Specifically, students will gain core knowledge in the NPRE discipline with additional competency in data science applications.

Educational objectives for the NPRE + DS program reflect the mission of the Department of Nuclear, Plasma, and Radiological Engineering and are consistent with ABET (Accreditation Board for Engineering and Technology) guidelines. The educational objectives are designed to position students to be successful in professional practice, to pursue advanced degrees, to assume professional and societal leadership roles, and to develop a commitment to lifelong learning.

The first two years of the NPRE curriculum provides a strong foundation in sciences (physics, mathematics, and chemistry), in engineering (mechanics and thermodynamics), in computer use, and in nuclear energy systems. Most of the technical core and concentration coursework takes place in the third and fourth years of the curriculum. Students choose from among three concentrations: power, safety and the environment; plasma and fusion science and engineering; and radiological, medical and instrumentation applications. Each concentration requires students acquire

a depth of understanding of the area but with flexibility to develop advanced technical expertise depending upon the student's specific educational and professional interests. Students demonstrate proficiency in the engineering design process in a senior design capstone course.

Course requirements may be found in the CIM Program of Study table above. Course descriptions attached.

Attach Program  
Description Files if  
needed

[Course Descriptions, NPRE + DS Program Description.docx](#)

## Graduation Requirements

Provide a brief narrative description of all graduation requirements, including, but not limited to, credit hour requirements, and, where relevant, requirements for internship, practicum, or clinical. For a graduate program, summarize information about the requirements for completion of the thesis or dissertation, including the thesis committees, and the final defense of the thesis or dissertation. If a thesis or dissertation is not required in a graduate program, explain how the functional equivalent is achieved.

The graduation requirements for the BS in Nuclear, Plasma, and Radiological Engineering + Data Science include a minimum GPA of 2.00 and a minimum of 128 credit hours, including general education requirements, the university residency requirement of 60 hours of UIUC coursework of which 21 are 300-or 400-level courses, and a minimum of 40 hours total of upper-division coursework. Finally, the course requirements outlined in the Program of Study section are also required. The total credit hours, 128, are in alignment with all other undergraduate degrees available from the Grainger College of Engineering and are necessary to ensure the curriculum is in compliance with the standards necessary for Accreditation Board for Engineering and Technology (ABET) accreditation.

## Specialized Program Accreditation

Describe the institution's plan for seeking specialized accreditation for this program. Indicate if there is no specialized accreditation for this program or if it is not applicable.

The NPRE Department at UIUC will seek to receive accreditation for the proposed BS in Nuclear, Plasma, and Radiological Engineering + Data Science program under the Nuclear and Radiological program category of ABET, the Accreditation Board for Engineering and Technology. ABET accreditation will provide assurance that the NPRE core of the NPRE + DS program is in line with the quality standards for which the program prepares graduates to enter the profession. This review will be provided every six years. The BS in Nuclear, Plasma, and Radiological Engineering has been accredited since 1978 (as Nuclear Engineering 1978 - 2012; as Nuclear, Plasma, and Radiological Engineering 2012 - present). The Department is due for its next ABET review in 2025.

## Licensure or Certification for Graduates of the Program

If this program prepares graduates for entry into a career or profession that is regulated by the State of Illinois, describe how it is aligned with or meets licensure, certification, and/or entitlement requirements.

NA

## Plan to Evaluate and Improve the Program

Describe the program's evaluation plan.

The NPRE Curriculum Committee, working closely with the NPRE Associate Head of Undergraduate Programs will monitor the NPRE + DS program along with support of the NPRE Undergraduate Programs advising staff. The curriculum committee consists of tenured, tenure-track, and specialized faculty members in the Department of Nuclear, Plasma, and Radiological Engineering. This committee will be responsible for making curricular decisions and responsible for managing the day-to-day aspects of the program.

Current NPRE Undergraduate Programs advising staff will assist with student recruitment, course scheduling and articulations, student interactions, scholarships, transfers (agreements, criteria, and advising), registration, study abroad agreements, student exchanges and other day-to-day business of running the program.

The NPRE Associate Head of Undergraduate Programs will be responsible for allocating advising duties and for developing best practices for advising. The existing undergraduate advising staff in NPRE will also advise the NPRE + DS students. Engineering Career Services is expected to be the primary facilitator of job placement for Grainger Engineering students. It is anticipated that a majority of graduates will enter industry, consistent with the placement of BS in Nuclear, Plasma, and Radiological Engineering graduates. Students may also matriculate to graduate programs, which is also consistent with current BS in Nuclear, Plasma, and Radiological Engineering graduates. Advisement for graduate school and professional placement will be through Nuclear, Plasma, and Radiological Engineering faculty, with personalized faculty advising for which individual student career interests will be paired to those faculty most capable of offering depth of knowledge and opportunities. Again, the NPRE Undergraduate Programs staff also serve as advising support for students.

Plan to Evaluate  
and Improve the  
Program  
Attachments

## Budget Narrative

### Fiscal and Personnel Resources

*Illinois Administrative Code: 1050.30(a)(5): A) The financial commitments to support the unit of instruction, research or public service are sufficient to ensure that the faculty and staff and support services necessary to offer the unit of instruction, research or public service can be acquired and maintained; B) Projections of revenues necessary to support the unit of instruction, research or public service are based on supportable estimates of state appropriations, local tax support, student tuition and fees, private gifts, and/or governmental grants and contracts.*

Budget Rationale

Provide financial data that document the university's capacity to implement and sustain the proposed program and describe the program's sources of funding.

Is the unit's (Department, College, School) current budget adequate to support the program when fully implemented? If new resources are to be provided to the unit to support the program, what will be the source(s) of these funds? Is the program requesting new state funds? (During recent years, no new funds have been available from the state (IBHE) to support new degree programs).

The program will be fully supported by student tuition from increased population of NPRE students brought in by the NPRE + DS opportunity, thus there will not be a need to financially support this program beyond this.

## Faculty Resources

Will current faculty be adequate to provide instruction for the new program or will additional faculty need to be hired? If additional hires will be made, please elaborate.

The proposed teaching responsibilities will be met by the existing faculty in Nuclear, Plasma and Radiological Engineering.

Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc.

The Department of Nuclear, Plasma, and Radiological Engineering currently has 13 full-time faculty with several open tenure-track positions. This faculty number is sufficient to support the proposed program.

There should be no impact on teaching loads for any NPRE faculty, given that all of the classes are already taught.

Eleven (11) existing NPRE courses are expected to experience increased enrollment (NPRE 100, 200, 247, 321, 330, 349, 441, 445, 449, 451, 455, 458); these are core required courses in the Nuclear, Plasma, and Radiological Engineering BS program. These courses currently have 24 - 47 enrolled students each year and will only be moderately affected by the increase of up to 8 new NPRE + DS students per year.

With regards to undergraduate to faculty ratio, current undergraduate numbers are at 127 making for a ratio of approximately 10 to 1. Additionally, NPRE has current graduate numbers of 117, including many graduate students who take 400-level NPRE courses that are required in the proposed NPRE + DS program. Thus, the increase of the estimated 32 students by the program fifth year mark will have very limited impact on teaching resources and faculty to student ratio.

Describe how the unit will support student advising, including job placement and/or admission to advanced studies. Will current staff be adequate to implement and maintain the new program or will additional staff be hired? Will current advising staff be adequate to provide student support and advisement, including job placement and or admission to advanced studies? If additional hires will be made, please elaborate.

The current staff of Nuclear, Plasma, and Radiological Engineering department will be sufficient to handle all new duties associated with the new degree program. The principle load for staff is represented by student advising activities. The existing undergraduate advising staff in NPRE will be able to take on the additional load caused by NPRE + DS students as it represents a rather modest increase from the current advising load. In addition, additional advising services are provided by the Grainger College of Engineering Undergraduate Programs Office and the Engineering Career Services office, for example for job placement for Grainger Engineering students, and the current staff of both of these programs will be able to handle the increased advising load from NPRE + DS students. The NPRE Department Head and Associate Head for Undergraduate Programs will be responsible for allocating advising duties and for developing best practices for advising.

Are the unit's current facilities adequate to support the program when fully implemented? Will there need to be facility renovation or new construction to house the program?

The NPRE department recently collaboratively invested in an expansion to our Talbot Laboratory facility, which houses the administrative offices, teaching laboratories, and instructional spaces that will directly support the NPRE + DS curriculum. Talbot Laboratory is located at 104 S. Wright Street, Urbana, IL 61801, right on the North West side of the Bardeen Quad.

Classroom space is assigned campus wide by the Office of the Registrar Catalog Management and Section Scheduling (CMSS). Sufficient classroom space is available for supporting the courses in the NPRE + DS program. The majority of classes are scheduled into classrooms located on or near the Bardeen Quad, the engineering quadrangle between Engineering Hall to Grainger Engineering Library. CMSS oversees the scheduling of classroom space, including campus Active Learning Classrooms, such as those located in the Campus Instructional Facility (CIF), a newly opened facility in Fall 2021. IFLEX classrooms (Illinois Flexible Learning Experience) support the campus mission for spaces that support new technology and teaching approaches. The classroom spaces available in CIF are designed to encourage small group discussion, collaboration, and peer interaction. CIF is located just adjacent to Talbot Laboratory and is used for a number of NPRE offered courses.

## Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

The Grainger Engineering Library is recognized as one of the top Engineering libraries in the nation. Located at 1301 W. Springfield Avenue, Urbana, IL 61801 it borders the North end of the Bardeen Quad. Library collections, resources and services are sufficient to support Nuclear, Plasma, and Radiological Engineering + Data Science, BS.

Summarize information about library resources for the program, including a list of key textbooks, a list of key text and electronic journals that will support this program, and a short summary of general library resources of the University that will be used by the program's faculty, students, and staff.

Extensive library print and electronic resources are available through the University of Illinois Urbana-Champaign Library system, including the outstanding Grainger Engineering Library (<https://www.library.illinois.edu/enx/>). Resources not available through the University of Illinois Urbana-Champaign collection may be requested through interlibrary loan or from partner research libraries throughout Illinois. Beyond its holdings and extensive study spaces, The Grainger Engineering library offers outstanding learning resources for students including the IDEA (Innovation, Discovery, Design & Data) Laboratory, which provides space and technology for collaboration, innovation, and entrepreneurship and supports a wide range of digital scholarship activities, the CARE (Center for Academic Resources in Engineering) center where students may find tutoring, advising and other services, and the Writers Workshop, which provide free writing assistance for University of Illinois students from all disciplines and at all stages of the writing process.

Key textbooks and electronic journals that will support the B.S. in Nuclear, Plasma, and Radiological Engineering+Data Science including:

Bergman, T., Lavine, A., Incropera, F., DeWitt, D. Fundamentals of Heat Mass Transfer, 8th edition; Wiley Publishing, Hoboken, New Jersey, 2020.

Griffiths, D. and Schroeter, D. Introduction to Quantum Mechanics, 3rd edition: Cambridge University Press, Cambridge, England, 2018.

Ott, K. and Winfred, B. Introductory Nuclear Reactor Statistics, revised edition; American Nuclear Society, La Grange Park, Illinois, 1989.

Shultis, J. and Faw, R. Fundamentals of Nuclear Science and Engineering, 3rd edition; CRC Press, Boca Raton, Florida, 2016.

Tsoufanidis, N. and Landsberger, S. Measurement and Detection of Radiation, 5th edition; CRC Press, Boca Raton, Florida, 2021.

Yip, S. Nuclear Radiation Interactions; World Scientific Publishing Company, Incorporated, Hackensack, New Jersey, 2014,

Nuclides and Isotopes: Chart of the Nuclides, 17th edition; Knolls Atomic Power Laboratory, Niskayuna, New York, 2010.

Are any sources of funding temporary (e.g., grant funding)? If so, how will the program be sustained once these funds are exhausted?

No. External grant funding is not needed to support the program. NPRE currently has low undergraduate enrollment. Its student-to-faculty ratio (UG students only) is low (below 10). There is substantial capacity to increase undergraduate enrollment in the unit without adding staff or faculty.



Budget Narrative  
Fiscal and  
Personnel  
Resources  
Attachments

## Personnel Budget

Please complete all lines below; all fields are required. For fields where there is no anticipated cost or need, enter 0 or NA.

Category                      Year One                      Year Five                      Notes

### Faculty (FTE)

| Faculty FTE Year1 | Faculty FTE Year 5 | Faculty FTE Notes |
|-------------------|--------------------|-------------------|
| 0                 | 0                  | NA                |

### Faculty (\$)

| Faculty Year 1 | Faculty Year 5 | Faculty Notes |
|----------------|----------------|---------------|
| 0              | 0              | NA            |

### Advising Staff (\$)

| Advising Staff Year 1 | Advising Staff Year 5 | Advising Staff Notes |
|-----------------------|-----------------------|----------------------|
| 0                     | 0                     | NA                   |

### Graduate

#### Students (\$)

| Graduate Students Year 1 | Graduate Students Year 5 | Graduate Students Notes |
|--------------------------|--------------------------|-------------------------|
| 0                        | 0                        | NA                      |

### Other Personnel

#### Costs

| Other Personnel Costs Year 1 | Other Personnel Costs Year 5 | Other Personnel Costs Notes |
|------------------------------|------------------------------|-----------------------------|
| 0                            | 0                            | NA                          |

Budget Narrative  
Attachments

## Facilities and Equipment

*Illinois Administrative Code: 1050.30(a)(4): A) Facilities, equipment and instructional resources (e.g., laboratory supplies and equipment, instructional materials, computational equipment) necessary to support high quality academic work in the unit of instruction, research or public service are available and maintained;*

*B) Clinical sites necessary to meet the objectives of the unit of instruction, research or public service;*

*C) Library holdings and acquisitions, owned or contracted for by the institution, that are necessary to support high quality instruction and scholarship in the unit of instruction, research and public service, are conveniently available and accessible, and can be maintained.*

Describe the facilities and equipment that are available, or that will be available, to develop and maintain high quality in this program. Summarize information about buildings, classrooms, office space, laboratories and equipment, and other instructional technologies for the program.

The data science core will be delivered by the i-School and the departments of Computer Science, Mathematics, and Statistics. The i-School and the Department of Computer Science are housed in buildings that provide classroom and lab spaces for students to engage with data science. The university has just completed construction of the Campus Instructional Facility and the Siebel Center for Design that provide outstanding modern research in data science. The university is currently renovating and rebuilding the buildings that house Mathematics and Statistics; the renovation provides for increased classroom and lab spaces for instruction and student research. Together these constitute excellent facilities for delivering the X + DS programs. Specific buildings and locations are:

I-School: Library and Information Science Building, 501 East Daniel Street, Champaign, IL 61820

Computer Science: Thomas M. Siebel Center for Computer Science, 201 North Goodwin Avenue, Urbana, IL 61801

Campus Instructional Facility: 1405 Springfield Avenue, Urbana, IL 61801

Siebel Center for Design: 1208 South Fourth Street, Champaign, IL 61820

Department of Mathematics: 273 Altgeld Hall, 1409 West Green Street, Urbana, IL 61801

Department of Statistics: Computing Applications Building, 605 East Springfield Avenue, Champaign, IL 61820

The Nuclear, Plasma, and Radiological Engineering courses are offered in classroom space assigned by the Office of the Registrar Catalog Management and Section Scheduling (CMSS). Sufficient classroom space is available with the majority scheduled into classrooms located on or near the Bardeen Quad, the engineering quadrangle between Engineering Hall and Grainger Engineering Library. This includes classroom space in the Campus Instructional Facility, located adjacent to Talbot Laboratory where the administrative offices of NPRES are based.

Department of Nuclear, Plasma, and Radiological Engineering: Talbot Laboratory, 104 South Wright Street, Urbana, IL 61801

Will the program require new or additional facilities or significant improvements to already existing facilities?

No

Will the program need additional technology beyond what is currently available for the unit?

No

Are there other

No

costs associated  
with  
implementing the  
program?

Facilities and  
Equipment  
Attachments

## Faculty and Staff

*Illinois Administrative Code: 1050.30(a)(3): A) The academic preparation and experience of faculty and staff ensure that the objectives of the unit of instruction, research or public service are met; B) The academic preparation and experience of faculty and staff, as evidenced by level of degrees held, professional experience in the field of study and demonstrated knowledge of the field, ensure that they are able to fulfill their academic responsibilities; C) The involvement of faculty in the unit of instruction, research or public service is sufficient to cover the various fields of knowledge encompassed by the unit, to sustain scholarship appropriate to the unit, and to assure curricular continuity and consistency in student evaluation; D) Support personnel, including but not limited to counselors, administrators, clinical supervisors, and technical staff, which are directly assigned to the unit of instruction, research or public service, have the educational background and experience necessary to carry out their assigned responsibilities.*

Describe the personnel resources available to develop and maintain a high quality program, including faculty (full- and part-time, current and new), staff (full- and part-time, current and new), and the administrative structure that will be in place to oversee the program. Also include a description of faculty qualifications, the faculty evaluation and reward structure, and student support services that will be provided by faculty and staff.

Within NPRE, the degree program will be developed and maintained by existing faculty and staff, following an administrative structure consistent with the BS in Nuclear, Plasma, and Radiological Engineering. This includes 13 faculty in the Nuclear, Plasma, and Radiological Engineering, a Senior Coordinator of Undergraduate Programs and Academic Advisor and the Associate Head of Undergraduate Programs. All undergraduate students will be assigned a faculty advisor.

All of the faculty have earned Ph.D. degrees in related fields and have extensive experience teaching the required courses in the proposed programs. The core faculty include:

Caleb Brooks, Associate Professor, Ph.D. in Nuclear Engineering  
Davide Curreli, Associate Professor and Donald Biggar Willett Faculty Scholar, Ph.D. in Sciences, Technologies and Measures for Space  
Angela Di Fulvio, Assistant Professor, Ph.D. in Nuclear Engineering and Industrial Safety  
Brent Heuser, Professor, Ph.D. in Nuclear Engineering  
Kathryn Huff, Ph.D. in Nuclear Engineering  
Tomasz Kozlowski, Associate Professor, Ph.D. in Nuclear Engineering  
Ling Jian Meng, Professor, Ph.D. in Detector Physics  
Zahra Mohaghegh, Associate Professor, Ph.D. in Reliability Engineering  
Magdi Ragheb, Associate Professor, Ph.D. in Nuclear Engineering/Computer Sciences  
David Ruzic, Abel Bliss Professor, Ph.D. in Physics  
R. Mohan Sankaran, Donald Biggar Willett Professor, Ph.D. in Chemical Engineering  
James Stubbins, Donald Biggar Willett Professor, Ph.D. in Materials Science  
Rizwan Uddin, Professor, Ph.D. in Nuclear Engineering

Assistant professors, associate professors, and professors allocate their time among teaching (40%), research (40%) and service (20%). All faculty are evaluated on an annual basis by the Department Head, and assistant and associate professors are also evaluated by the Nuclear, Plasma, and Radiological Engineering Department's Promotion and Tenure Committee.

The Data Science courses of the NPRE + DS program will be supported by the four departments of Computer Science in Grainger College of Engineering, Mathematics and Statistics in the College of Liberal Arts and Sciences, and Information Sciences in the School of Information Sciences. The four units are responsible for overseeing the teaching of the Data Science Core courses in the NPRE + DS program. Sufficient faculty coverage exists for the offering of the eight core Data Science courses in the NPRE + DS program. A partial list of recent faculty teaching these courses follows:

Karle Flanagan, Teaching Assistant Professor, Dept. of Statistics, Ph.D. in Curriculum & Instruction  
Wade Fagen-Ulmschneider, Teaching Associate Professor, Dept. of Computer Science, Ph.D. in Computer Science

Julie Deeke, Teaching Assistant Professor, Dept. of Statistics, Ph.D. in Statistics  
 Tori Ellison, Teaching Assistant Professor, Dept. of Statistics, Ph.D. in Operations Research  
 Mahesh Viswanathan, Professor, Dept. of Computer Science, Ph.D. in Computer and Information Science  
 Bo Li, Assistant Professor, Dept. of Computer Science, Ph.D. in Computer Science  
 Brad Solomon, Teaching Assistant Professor, Dept of Computer Science, Ph.D. in Computational Biology  
 Peter Darch, Assistant Professor, School of Information Sciences, Ph.D. in Computer Science  
 Emily Maemura, Assistant Professor, School of Information Sciences, Ph.D. in Faculty of Information

Summarize the major accomplishments of each key faculty member, including research/scholarship, publications, grant awards, honors and awards, etc. Include an abbreviated curriculum vitae or a short description.

Please see attached Faculty Bios.

Faculty and Staff [Faculty Bios.docx](#)  
 Attachments

## HLC Section

### Credit Hours

|   |                                |                          |
|---|--------------------------------|--------------------------|
| Existing or repackaged curricula<br>(Courses from existing inventory of courses):                 | Number of Credit Hours:<br>100 | 128<br>Percent of Total: |
| Revised or redesigned curricula (Courses for which content has been revised for the new program): | Number of Credit Hours:<br>0   | 0<br>Percent of Total:   |
| New curricula (Courses developed for the new program that have never been offered):               | Number of Credit Hours:<br>0   | 0<br>Percent of Total:   |
| Total Credit Hours of the Program:<br><br>100   | Number of Credit Hours:        | 128<br>Percent of Total: |

### New Faculty Required

Will new faculty expertise or new faculty members be needed to launch this program?

No

Please explain existing coverage:

NPRE faculty are highly accomplished with extensive experience in teaching undergraduate and graduate courses in nuclear, plasma and radiological engineering. They also have experience in advising undergraduate students, and conducting

research on related topics. No additional faculty expertise will be required to launch the program, current coverage is sufficient.

## Additional Funds

Will the proposed program require a large outlay of additional funds by the institution?

No

## Institutional Funding

Please explain institutional funding for proposed program:

The current institutional funding model encompasses the courses required for this concentration. Therefore, no additional funds are needed for this program.

## EP Documentation

EP Control Number            EP.25.008

Attach Rollback/Approval Notices            [ep\\_25008\\_letter\\_from\\_AJ\\_Schmidt\\_20240815.pdf](#)  
[ep25008\\_letter\\_of\\_support\\_and\\_seats\\_statistics\\_20240916.pdf](#)

This proposal requires HLC inquiry            No

## DMI Documentation

Attach Final Approval Notices

Banner/Codebook Name

Program Code:

| Minor Code | Conc Code | Degree Code | Major Code |
|------------|-----------|-------------|------------|
|------------|-----------|-------------|------------|

Senate Approval Date

Senate Conference Approval Date

BOT Approval Date

IBHE Approval Date

HLC Approval

Date

DOE Approval

Date

Effective Date:

Attached

Document

Justification for  
this request

Program Reviewer  
Comments

**Brooke Newell (bsnewell) (03/03/23 9:49 am):** Rollback: Email sent to Becky, Ashley, and Mike

**Brooke Newell (bsnewell) (10/25/23 1:07 pm):** Rollback: Email sent to Becky, Tomasz, and Ashley

**Brooke Newell (bsnewell) (12/04/23 9:22 am):** Rollback: per discussion with Becky

**Brooke Newell (bsnewell) (12/04/23 11:15 am):** Rollback: Per discussion with Becky

**Brooke Newell (bsnewell) (04/25/24 8:37 am):** Rollback: Per discussion with Ashley

**Brooke Newell (bsnewell) (05/10/24 9:47 am):** Rollback: Discussion and email sent to Ashley

**Nolan Miller (nmiller) (09/18/24 10:30 am):** Compiled letters of support document includes letters from Math, Chemistry, Engineering (ENG), Physics, Mechanical Science and Engineering, Computer Science, Statistics, Information Sciences, and Economics.