This course proposal form should be completed when introducing a new course or a revision of an existing course. The proposal will be reviewed by the Committee on Curriculum, or, in the case of minor revisions, will be approved administratively by the Associate Provost for Instruction.

This Course Proposal must be completed according to the guidelines provided in Course Proposal Form – Instructions and Guidance. Please see the last page of Course Proposal Form – Instructions and Guidance, for instructions on how this Course Proposal should be submitted to the Committee on Curriculum for review.

Date: October 7, 2019

1. Course Information:

1.1 Course Prefix and Number: BPE 450
Course Title: Chemical and Bioprocess Engineering Product Design
(If a new or renumbered course, please check with the Registrar regarding the use or reuse of the course number)

1.2 ☒ This is a New Course.
OR
☐ This is a Major Course Revision
OR
☐ This is a Minor Course Revision

If this is a Course Revision, please see Course Proposal Form – Instructions and Guidance to determine if your revision is major or minor. Indicate below the reason(s) for the revision.

(Please check all that apply)
☐ Course Number/Division ☐ Learning Outcomes ☐ Institutional Resources
☐ Title ☐ Concepts, Content ☐ Semester Offered
☐ Credit hours ☐ Catalog Description ☐ Course Inactivation
☐ Pre- or Co-requisite(s) ☐ Instructional Methods ☐ Course Reactivation
☐ Format ☐ General Education

1.3 General Education knowledge and skills area (if applicable): If none, check here ☒
☐ American History ☐ Humanities ☐ Other World Civilizations
☐ The Arts ☐ Mathematics ☐ Social Sciences
☐ Basic Communication ☐ Natural Sciences ☐ Western Civilization
2. Proposer Need Statement:

2.1 Describe why this course (or course revision) is needed to meet current or proposed goals and outcomes of the program or College, and, if a revision, provide an explanation of and justification for the revision.

Among the current courses at ESF, there is no coverage of Product Design other than in a limited fashion in the experimental course, PSE 496 Six Sigma training. This new course is intended to provide students with relevant knowledge in this area.

2.2 List the pre-requisite or co-requisite courses (taught within the home department or taught by another department) and explain their relationship to the proposed course. APM 395 and senior standing in Bioprocess or Chemical Engineering. APM 395 provides students with a foundation in statistical analysis, which is required for product design. BPE 362 Chemical Engineering Thermodynamics and Colloids. BPE 362 is a key required sophomore course in both Chemical Engineering and Bioprocess Engineering.

2.3 Explain the impact of this course in meeting the goals and outcomes of other Departments/programs (if any). N/A

2.4 If the proposed course is designed to fulfill SUNY General Education Requirements, the Associate Provost for Instruction must review this proposal to ensure that General Education Requirements will be met for the specified knowledge area (See Instructions and Guidance). Please provide an explanation of how this course fulfills SUNY General Education Requirements.

2.5 What are the staffing requirements (instructor, TA, Lab tech, etc.) for this course? If a new course, are there new staffing needs or are there adequate staff members already in place? If a revised course, are there additional staffing needs? TA support. When faculty replacement occurs, emphasis will be made to support the Chemical Engineering core courses, including this course.

2.6 What Department (or extra-Department) resources are or will be made available to support the course or course revision? Classroom.

2.7 Anticipated Enrollment (enter where applicable)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Enrollment</th>
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<tbody>
<tr>
<td>Fall Semester</td>
<td>10-80</td>
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<tr>
<td>Spring Semester</td>
<td></td>
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<tr>
<td>Summer Semester</td>
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</table>

2.8 Anticipated frequency of class meetings. 3 hours per week of lecture.
3. DETAILED COURSE DESCRIPTION

3.1 COURSE IDENTIFICATION AND FORMAT:

3.1.1 Course Prefix and Number: BPE 450
3.1.2 Course Name: Chemical and Bioprocess Engineering Product Design
3.1.3 Credit Hours: 3
3.1.4 Semester (check all that apply): Fall ☒ Spring ☒ Summer ☐
3.1.5 Format (check as appropriate): Lecture ☒ Online ☐ Lab ☐ Field ☐
   Other ☐ (explain)
3.1.6 Contact hours per week: 3 hours of lecture
3.1.7 Prerequisite(s) – if none, please enter “None” (Be specific, as Upper Division courses and Graduate courses will likely have some pre-requisite knowledge) APM 395 and BPE 362

3.2 SCOPE:

3.2.1 Level of Instruction (check one, or two if a shared resource course):
   Lower Division ☐ Upper Division ☒
   Beginning Graduate ☐ Advanced Graduate ☐

3.2.2 Relation to curriculum or to other ESF or Syracuse University courses:
   a. Is this a required course? No ☐ Yes ☒.
      If Yes, please list the program(s) for which it is a requirement: Chemical Engineering and Bioprocess Engineering
   b. Is this an elective course within your department? No ☐ Yes ☒.
   c. Is enrollment in this course restricted? No ☒ Yes ☐
      If Yes, please explain:
   d. Are other ESF or SU courses similar or identical to this course? No ☒ Yes ☐.
      If Yes, please identify the courses:
   e. Is this course a shared resource offering (i.e. is there a graduate or undergraduate concurrent offering)? No ☒ Yes ☐.
      If Yes, what is the course number of the concurrent offering?

3.3 STUDENT LEARNING OUTCOMES:

Identify the student learning outcomes associated with this course. At the completion of this course, student will have the ability to

1. Identify, formulate, and solve complex problems in chemical and bioprocess engineering devices and product design in quality and characteristics.

2. Apply the engineering design process to produce solutions for product quality and/or process that meet specified needs with consideration for public health and safety, and global, cultural, social, environmental, economic and other factors.

3. Recognize ethical and professional responsibilities in chemical and/or bioprocess device, product life-time performance and make informed judgments, which should consider the impact of the product in global, economic, environmental, and societal contexts.
4. Recognize the ongoing need to acquire new knowledge, to choose appropriate learning strategies, and to apply this knowledge in chemical / bioprocess engineering devices and product.

3.4 MAJOR CONCEPTS, PROCESSES or TOOLS:

Identify the course content and themes (e.g. Table of Contents) consistent with the learning domains and outcomes.

1. Introduction to experimentatation, factors and experimental objectives.
2. Analysis of product quality, product value, and production variables.
3. Investigation of product quality control by design.
4. Study cases of product designs.

3.5 INSTRUCTIONAL METHODS:

Identify the methods used to meet the course outcomes, as well as the principal instructional methods.

3 hours of lecture per week provided by instructor and guest experts. Instructor will provide lectures with slides, class homework assignments, exams, open ended group and/or individual projects.

3.6 CATALOG DESCRIPTION

Provide the course description using the precise format to be included in the ESF catalog (i.e. course number and title; format; brief description; semester(s) offered; and pre-/co-requisites). Please do not exceed 1000 characters.

BPE 450. Chemical and Bioprocess Engineering Product Design (3)

3 hours of lecture per week. Quality by design of chemical and biochemical products range from specialty chemicals like protein/tissue, biologics to devices that perform chemical and/or biotransformations. This course integrates the steps of product design from brainstorming and concept selection through design and manufacturing. Students will be taught and practice using the basic tools and principles of chemical / biochemical product design, including inventive problem solving (or TRIZ), house of quality, robust design, design for manufacturability, Failure Modes and Effects Analysis (FMEA) and Six Sigma. Other topics include multi-generational product planning, sustainability and life cycle analysis, basic economic evaluations, risk management, an introduction to entrepreneurship and new business development, as well as intellectual property and freedom-to-operate assessments. Case studies drawn from industry will also be illustrated. Fall or Spring.

Pre-requisites: APM 395 and BPE 362.

3.7 COURSE HISTORY:

Provide the dates of prior approval of this course, and its revision history.
3.7.1 Relationship to current ESF courses

This course is replacing a current ESF course  □ YES  ☒ NO

If NO, then proceed to section 4 below.

If YES, then provide below the number and name of the course to be deactivated and removed from the catalog once this course proposal has been approved:

Course Number (of the course to be replaced)
Course Name (of the course to be replaced)

If the course to be replaced is used by departments other than the department sponsoring this proposal, please indicate below which departments are affected and the date they were notified about the course replacement.

Department:            Date of Notification:
Department:            Date of Notification:
Department:            Date of Notification:
Department:            Date of Notification:
4. Institutional Impacts:

This section pertains to forecasting institutional resource needs to support the course or course revision. Provide clear statements regarding the needs and current availability (or absence) of resources. Note that, if this is a course revision, only the impacts of the revision should be included.

**Staffing needs:**
Instructor

**Classroom resources (e.g. physical facilities in a laboratory, lecture hall, flexible space, academic computing):**
Lecture hall

**Technology Resources:**
Projector, black/white board

**Computing Resources (software licensing, hardware, access):**
Microsoft Office

**Library Resources (subscriptions, services):**
No

**Transportation Requirements (budget, fees, fleet vehicles):**
No

**Forest Properties or Field Practicum Facilities:**
No
5. Health and Safety Considerations:

Will any of the conditions or situations outlined below be present in association with the course?

Yes / No

5.1. Will substances with any of the following properties be used during instruction: flammability, toxicity, corrosivity, reactivity, registered pesticide, legally controlled, or other characteristics with the potential to cause harm or injury?

☐ / ☒

5.2. Will any physical hazards be present during instruction? (e.g., machines that need safety guards; razor blades or syringes; compressed gases, etc.).

☐ / ☒

5.3. Will any biological hazards be present during instruction? (e.g., handling animals (rabies or hantavirus); cultures or stocks of infectious agents (fungal spores, viruses, bacteria, etc.).

☐ / ☒

5.4. Will any radiation hazards be present during instruction? (e.g., radioisotopes, X-rays, ultraviolet rays, lasers, etc.).

☐ / ☒

5.5. Will any electrical equipment that, due to its design, location, or method of use, pose any threat to safety during instruction? (Give considerable thought to electrical use outdoors, or any potentially wet location.).

☐ / ☒

5.6. Will there be any personal safety issues related to the class? (e.g., due to time of day or location, at the end of any organized class exercise, will students be in danger of physical assault, etc.).

☐ / ☒

5.7. Will any students be driving official state or research sponsored land or water vehicles during any class or instructional exercise?

☐ / ☒

5.8. Will any type of personal protective equipment be necessary during class exercises? (e.g., hard-hats, eye/face protection, hearing protection, hand/foot protection, lab coat, visibility clothing, etc.)

☐ / ☒

If the answer was “Yes” to any of the HEALTH AND SAFETY questions, please explain:

For lab and field courses to which all answers are “no”, you should explain that here, also. Normally, we would expect some safety precautions for such courses.
### 6. Coordination and Consultation

Emails/letters, as noted below and attached to this proposal, or signatures below, indicate that the affected departments, programs or units have been notified of this proposal and have had an opportunity to assess the impact of the proposal on their respective units.

**Affected Academic Department(s) or Program(s) – other than the sponsoring department:**

<table>
<thead>
<tr>
<th>Department/Program</th>
<th>Name of Chair/Program Director</th>
<th>Chair Signature</th>
<th>Date</th>
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<tr>
<td>Department/Program 1</td>
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<td>Department/Program 3</td>
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*If more than three Departments/Programs, please continue on a separate page*

**Other Units:**

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<tr>
<th>Unit</th>
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<th>Chair Signature</th>
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<tr>
<td>Associate Provost for Instruction &amp; Dean of the Graduate School (for Gen Ed courses only)</td>
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<td>Registrar</td>
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<td>Library Director</td>
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<td>Environmental Health and Safety</td>
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7. Proposer Information and Sponsoring Department Chair Affirmation:

Contact Person:

Name: Shijie Liu ________________________________ Department: Paper and Bioprocess Engineering __________________________

Email: sliu@esf.edu ________________________________

Phone: 6885 ________________________________

This proposal has been reviewed and approved by the sponsoring Department. Affected departments have been notified and given the opportunity to provide feedback. Department resources are or will be made available to support the course, or a plan is in place to meet the resource needs as identified in the Institutional Impacts section of this proposal (see Section 4, above).

Name: __________________________________________ Date: ______

Department Chair (or designated curriculum representative)

Signature: ______________________________________ Or letter attached □

Department Chair (or designated curriculum representative)

8. Approvals:

________________________________________ Date

Curriculum Committee

________________________________________ Date

Faculty Governance

________________________________________ Date

Provost