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: 14 October 2019

1. Course Information:

1.1 Course Prefix and Number: BPE 362
   Course Title: Chemical Engineering Thermodynamics & Colloids
   (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. BPE 362 is a new course for the Bioprocess Engineering Program and the forthcoming Chemical Engineering Program to be offered by the (current) Department of Paper and Bioprocess Engineering. This course will be primarily focused on those aspects of reaction equilibrium and solutions thermodynamics, together with colloids and interface science, which are of interest to chemical engineers.

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. Pre-requisites are PSE 361 (Engineering Thermodynamics), which is a first course in engineering thermodynamics.

2.3 Explain the impact of this course in meeting the goals and outcomes of other Departments/programs (if any). It is a required course.

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. N/A

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? Instructor and one teaching assistant

2.6 What Department (or extra-Department) resources are or will be made available to support the course or course revision? 1 teaching assistant

2.7 Anticipated Enrollment (enter where applicable)

<table>
<thead>
<tr>
<th>Semester</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Fall Semester</td>
<td></td>
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<tr>
<td>Spring Semester</td>
<td>15 - 60</td>
</tr>
<tr>
<td>Summer Semester</td>
<td></td>
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</tbody>
</table>

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

3.1 COURSE IDENTIFICATION AND FORMAT:

3.1.1 Course Prefix and Number: BPE
3.1.2 Course Name: 362
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
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) PSE 361 (Engineering Thermodynamics)

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: Bioprocess Engineering and Chemical 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: CEN 353 (Chemical Engineering Thermodynamics II)
   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? N/A

3.3 STUDENT LEARNING OUTCOMES:

Identify the student learning outcomes associated with this course.

At the completion of this course, students will have the ability to

1. Describe thermodynamic functions of internal energy, enthalpy, free energy, chemical potentials of single and multicomponent systems.

2. Describe relations of phase equilibria and apply them.

4. Describe chemical reaction equilibrium, equilibrium constant, as affected by temperature and pressure.

5. Define, classify and analyze colloidal systems of biological origin.

6. Analyze diffusion and sedimentation of biocolloidal particles including proteins and other macromolecules.

7. Describe & apply concepts of surface energy, surface tension, capillarity, wicking and drops on surfaces.

8. Describe & apply concepts of surface adsorption thermodynamics, energetics and kinetics at biointerfaces.

9. Describe & apply concepts of colloidal stability to suspensions of biological materials including intermolecular potentials and electrical double layers.

10. Apply concepts of electrokinetics and analyze the behavior of colloidal systems.

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.

The course consists of lectures, discussions, quizzes, exams, student seminars, laboratory work, and homework.

The course covers some of the fundamental aspects of thermodynamics from a chemical engineering viewpoint. Topics include the following:

1) Volumetric Properties of Pure Fluids: PVT behavior, equations of state for gases and liquids;

2) Heat Effects: Sensible heat effects, latent heats of pure substances, heats of formation, reaction and combustion;

3) Thermodynamic Properties of Fluids: Property relations for homogenous phases, residual properties, two-phase systems, thermodynamic diagrams, tables of thermodynamic properties, generalized property correlations for gases;

4) Vapor-Liquid Equilibrium (VLE): Nature of equilibrium, Phase Rule, Duhem's Theorem, VLE models;

5) Theory of Solution Thermodynamics: Fundamental property relation, chemical potential and phase equilibria, partial properties, ideal-gas mixture model, fugacity and fugacity coefficient (for pure species and species in solution), generalized correlations for the fugacity coefficient, ideal-solution model, excess properties;

6) Applications of Solution Thermodynamics: Liquid-phase properties from VLE data, models for excess Gibbs energy, property changes of mixing, heat effects of mixing processes;
7) Chemical-Reaction Equilibria: Reaction coordinate, applications of equilibrium criteria to chemical reactions, standard Gibbs energy change and the equilibrium constant, effect of temperature on the equilibrium constant, evaluation of equilibrium constants and their relation to composition, equilibrium conversions for single reactions, Phase Rule and Duhem's Theorem for reacting systems, multireaction equilibria;

8) Colloidal system thermodynamics: Osmotic pressure, equations of state, charged biocolloids & macromolecules, Donnan membrane equilibria in biocolloids.

9) Surface Energetics: Surface tension, surface energy, bubbles, Laplace & Young equations.


12) Polymer adsorption at interfaces.

13) Electrokinetics – electrophoresis & other effects

3.5 INSTRUCTIONAL METHODS:

Identify the methods used to meet the course outcomes, as well as the principal instructional methods. Lectures, discussions, problem solving, homework assignments, and exams.

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 362: Chemical Engineering Thermodynamics & Colloids (3)

Three hours of lecture per week. Topics include thermodynamic properties of pure fluids and mixtures of fluids; vapor-liquid equilibrium, theory and applications of solution thermodynamics, chemical reaction equilibria, and colloidal systems. Spring.

Prerequisite(s): PSE 361

3.7 COURSE HISTORY:

Provide the dates of prior approval of this course, and its revision history. This is a new course (first proposed on 14 October 2019).

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.

<table>
<thead>
<tr>
<th>Department</th>
<th>Date of Notification</th>
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</table>
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.

<table>
<thead>
<tr>
<th>Staffing needs:</th>
<th>N/A</th>
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</thead>
<tbody>
<tr>
<td>Classroom resources (e.g. physical facilities in a laboratory, lecture hall, flexible space, academic computing):</td>
<td>Lecture hall</td>
</tr>
<tr>
<td>Technology Resources:</td>
<td>Projector, document camera, black or white board</td>
</tr>
<tr>
<td>Computing Resources (software licensing, hardware, access):</td>
<td>Microsoft Office/LibreOffice, Internet</td>
</tr>
<tr>
<td>Library Resources (subscriptions, services):</td>
<td>Journals and databases</td>
</tr>
<tr>
<td>Transportation Requirements (budget, fees, fleet vehicles):</td>
<td>None</td>
</tr>
<tr>
<td>Forest Properties or Field Practicum Facilities:</td>
<td>None</td>
</tr>
</tbody>
</table>
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:

Department/Program 1
Name of Chair/Program Director
Chair Signature
Date

Department/Program 2
Name of Chair/Program Director
Chair Signature
Date

Department/Program 3
Name of Chair/Program Director
Chair Signature
Date

[if more than three Departments/Programs, please continue on a separate page]

Other Units:

Associate Provost for Instruction & Dean of the Graduate School (for Gen Ed courses only)
Date

Registrar
Date

Library Director
Date

Computing and Network Services
Date

Physical Plant
Date

Forest Properties
Date

Environmental Health and Safety
Date
7. Proposer Information and Sponsoring Department Chair

Affirmation:

Contact Person:

Name: Siddharth G. Chatterjee _______________________
Department: Paper and Bioprocess Engineering

Email: schatterjee@esf.edu _______________________
Phone: 315-470-6517

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: Bandaru Ramarao _____________________________________________
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