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: 2/17/2021

1. **Course Information:**

1.1 Course Prefix and Number: ERE 580

   Course Title: Fate and Transport of Contaminants
   (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. This course meets the goals of the department of Environmental Resources Engineering (ERE) by supporting its M.S., M.P.S. and Ph.D. programs. It also meets the goals of the College by supporting the Graduate Program in Environmental Science (GPES) under the Division of Environmental Science. The course has been offered as a special topics class for the past one year, with small graduate enrollment numbers. Students taking this course will learn fundamental physical, chemical, and biological principles and contemporary knowledge necessary to identify, conceptualize and solve contamination issues in both natural and engineered environments. The proposed official designation will elevate the course visibility to current and prospective graduate students, enhance the rigor of the aforementioned graduate programs, and thus increase our ability to recruit and retain graduate students.

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. Prerequisite: Calculus, General Chemistry, and Introduction to Ecological/Environmental Engineering, or equivalent. These courses prepare students for fundamental chemistry (e.g., reaction stoichiometry, equilibrium, kinetics, redox potential) and engineering knowledge and quantitative analysis skills (e.g., differentiation and integration techniques).

2.3 Explain the impact of this course in meeting the goals and outcomes of other Departments/programs (if any). This course is not required by any other ESF department or program. Understanding and analyzing fate and transport of contaminants in natural and engineered environments is crucial to professionals, scientists, and researchers in the areas of environmental engineering, environmental science, and environmental health. Therefore, the course could be of interest to students in the GPES program, thus supporting the goals and outcomes of the Division of Environmental Science.

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 TA shared with ERE 480. No additional staff needs.

2.6 What Department (or extra-Department) resources are or will be made available to support the course or course revision? This course will share with ERE 480 the resources currently available from ERE.

2.7 Anticipated Enrollment (enter where applicable)
2.8 Anticipated frequency of class meetings. Twice/week (80 min each time)
3. DETAILED COURSE DESCRIPTION

3.1 COURSE IDENTIFICATION AND FORMAT:

3.1.1 Course Prefix and Number: ERE 580
3.1.2 Course Name: Fate and Transport of Contaminants
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) Prerequisite: Calculus, General Chemistry, and Introduction to Ecological/Environmental Engineering, or equivalent. These courses prepare students for fundamental chemistry (e.g., reaction stoichiometry, equilibrium, kinetics, redox potential) and engineering knowledge and quantitative analysis skills (e.g., differentiation and integration techniques).

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:
   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? ERE 480

3.3 STUDENT LEARNING OUTCOMES:

Identify the student learning outcomes associated with this course.

At the completion of this course students will be able to:
1. Discuss the importance of fate and transport of contaminants in global, regional and local environmental issues.
2. Describe fundamental physical, chemical, and biological principles of fate and transport of contaminants in natural and engineered environments.
3. Apply the fundamental principles to identify, conceptualize, formulate, and solve complex contamination problems.
4. Explain fate and transport of common contaminants in various environments.
5. Acquire new knowledge of contemporary contamination issues using appropriate learning
strategies.
6. Present a mini review on a contemporary contamination issue (among the provided topics) to
   1) synthesize the source of an emerging contaminant and its fate and transport in the natural
   environment, 2) discuss social, environmental, and health impacts of the contaminant, and 3)
   analyze its treatment and remediation by current technologies.
7. Evaluate mini review papers developed by peer graduate students and provide review reports
   on their strength and weakness in achieving Goal 6.

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.

This course will cover the following concepts:
1. Basic concepts:
   a. Chemical concentration, control volumes, mass balance
   b. Advective/Fickian transport, the advection-dispersion-reaction equation
   c. Basic environmental chemistry/physical chemistry
   d. Chemical distribution among phases
2. Surface waters:
   a. Physical transport in surface water
   b. Sediment transport, particle settling, sediment record
   c. Air-water exchange
   d. Acid-base chemistry, redox chemistry
   e. Dissolved oxygen modeling
   f. Biotransformation and biodegradation, modeling biodegradation
   g. Bioconcentration and bioaccumulation
   h. Abiotic chemical transformation
3. Subsurface environment:
   a. Flow of nonaqueous phase liquids
   b. Retardation
4. Atmosphere:
   a. Atmospheric stability and circulation
   b. Transport of chemicals in the atmosphere
   c. Physical removal of chemicals and chemical reactions
   d. The greenhouse effect and global climate change

3.5 INSTRUCTIONAL METHODS:

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

Delivery:
1. Lectures on major concepts, supported by reading textbook, relevant journal articles, agency
documents, and pertinent multimedia resources.
2. Discussion of assigned readings and supplementary materials.
3. Guest lecture by professionals in the wastewater/solid waste treatment area.
4. Guidance for developing research papers on contemporary contamination issues, including
database search, literature selection, and writing.
5. Seminar discussion on contemporary contamination issues and peer review of research
papers.

Evaluation:
1. Pre- and post-course surveys to check whether students understand the importance of fate
and transport of contaminants in global, regional and local environmental issues.
2. In-class quizzes that require students to describe fundamental principles of fate and transport
and common contaminants in natural and engineered environments.
3. Weekly/biweekly assignments that require students to apply fundamental principles to identify,
conceptualize, formulate, and solve complex environmental resources engineering problems.
4. Exams that require students to describe and apply fundamental principles, and explain
common contaminants in various environmental compartments.
5. Active participation in seminar discussion on contemporary contamination issues.
6. A mini review paper on a chosen contemporary contamination issue.
7. Oral presentation of major findings and conclusions in the research paper.
8. Peer-view report of papers developed by other graduate students in this course.

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.

ERE 580 Fate and Transport of Contaminants (3)
Three hours of lecture per week. The fundamental physical, chemical, and biological principles of
fate and transport of contaminants. Application of the fundamental principles to analyze complex
contamination problems in surface waters, subsurface environment, atmosphere, and engineered
environments. Graduate students will write a research paper on contemporary contamination
issues. Fall.
Prerequisite: Calculus, General Chemistry, and Introduction to Ecological/Environmental
Engineering, or equivalent.
Note: Credit will not be granted for both ERE 480 and ERE 580.

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.
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 and TA (shared with ERE 480)

Classroom resources (e.g. physical facilities in a laboratory, lecture hall, flexible space, academic computing): Medium to large classroom for 45-55 students in ERE 580 & ERE 480

Technology Resources: LCD projector, internet access, white boards or document project

Computing Resources (software licensing, hardware, access): Microsoft office, Zotero (open source)

Library Resources (subscriptions, services): None

Transportation Requirements (budget, fees, fleet vehicles): None

Forest Properties or Field Practicum Facilities: None
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:**

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<th>Department/Program</th>
<th>Name of Chair/Program Director</th>
<th>Chair Signature</th>
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*If more than three Departments/Programs, please continue on a separate page*

**Other Units:**

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<td>Associate Provost for Instruction &amp; Dean of the Graduate School (for Gen Ed courses only)</td>
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7. Proposer Information and Sponsoring Department Chair Affirmation:

Contact Person:

Name: Yaqi You ___________________________ Department: ERE ________________

Email: yyou@esf.edu ___________________________
    Phone: X6765 ___________________________

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: Lindi Quackenbush __________________________________________ Date: 28 Feb 2021 ______

Department Chair (or designated curriculum representative)

Signature: __________________________________________ Or letter attached ✗

Department Chair (or designated curriculum representative)

8. Approvals:

________________________  __________________________
Curriculum Committee  Date

________________________  __________________________
Faculty Governance  Date

________________________  __________________________
Provost  Date