CEGR 5273 Soil Improvement

Proposed and to be taught by:
Dr. Vincent Ogunro, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description
CEGR 5273. Soil Improvement. (3). Prerequisites: CEGR 3278 - Geotechnical Engineering I or consent of the instructor, graduate student status. Engineering principles of soil improvement as they relate to applications in both geotechnical and geoenvironmental engineering; innovative techniques to improve soils to meet technical and economic requirements. *(Spring)*

# Credit Hours: 3

Frequency: Offered every spring semester

Prerequisites: CEGR 3278 - Geotechnical Engineering I or consent of the instructor, graduate student status.

Course Objectives
The objectives of this course are to review soil properties and the need for soil improvement, densification of soils through deep and shallow compaction; vibrocompaction, vibroreplacement, dewatering through consolidation, drainage, pumping and electrokinetics; modification through heating and freezing techniques; reinforcement with geosynthetics; grouting, stabilization with additives including industrial by-products and waste materials.

Expected Outcomes
After completion of this course, students should be able to specify and apply techniques to improve soils that are otherwise unsuitable for use in geotechnical and geoenvironmental applications.

Instruction Method: Lecture

This semester-long course is divided into three modules. The course will progress in sequence, and students are required to make a B or better in each module to pass the course.

<table>
<thead>
<tr>
<th>Module Number and Name</th>
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<tr>
<td>Module 1: Geotechnical Engineering Review</td>
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<td>Module 2: Physical Methods</td>
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<td>Module 3: Chemical Methods</td>
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Reference Texts
Because of the multitude of sources of relevant information and the unique nature of this course, no single textbook is required. Notes and relevant material will be provided and the following texts may serve as reference material.
• “Ground Control and Improvement” Xanthakos, P.P., Abramson, L.W. and Bruce, D.A. 1994, John Wiley and Sons.

Evaluation and Grading:
- Exam 1:  20%
- Exam 2:  20%
- Exam 3:  20%
- Term paper:  15%
- Homework:  25%

Course Outline
Module 1: Geotechnical Engineering Review
  Lecture 1: Introduction, soil improvement applications, difficult soils, site investigation
  Lecture 2: Flow through soils, well drawdown, effective and total stress, surcharge
  Lecture 3: Shear strength in sands, clays.
  Lecture 4: Bearing capacity and consolidation
  Lecture 5: Slope stability and earth pressure
  EXAM 1

Module 2: Physical Methods
  Lecture 6: Preloading, vertical drains, pumping
  Lecture 7: Vibroflotation, vibroreplacement
  Lecture 8: Blasting, dynamic compaction
  Lecture 9: Freezing, heating
  Lecture 10: Geosynthetics
  EXAM 2

Module 3: Chemical Methods
  Lecture 11: Grouting
  Lecture 12: Deep soil mixing
  Lecture 13: Electrokinetics
  Lecture 14: Admixtures, lime, Utilization of waste materials
  EXAM 3
CEGR 5274 Site Characterization

Proposed and to be taught by:
Dr. Vincent Ogunro, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description
CEGR 5274. Site Characterization. (3). Prerequisites: CEGR 3278 - Geotechnical Engineering I or consent of the instructor, graduate student status. Site investigation and site assessment technologies employed in geotechnical and environmental engineering; Site investigation planning and various geophysical methods including: seismic measurements, ground penetrating radar, electrical resistivity, and electromagnetic conductivity; Drilling methods for soil, gas and ground water sampling; decontamination procedures; and long term monitoring methods; Conventional and state-of-the-art in situ methods for geotechnical and environmental site characterization: standard penetration test, vane shear test, dilatometer test, pressuremeter test and cone penetration tests. Modern advances in cone penetrometer technology, instrumented with various sensors (capable of monitoring a wide range of physical and environmental parameters: load, pressure, sound, electrical resistivity, temperature, PH, oxidation reduction potential, chemical contaminants). (Fall)

# Credit Hours: 3

Frequency: Offered every fall semester

Prerequisites: CEGR 3278 - Geotechnical Engineering I or consent of the instructor, graduate student status.

Course Objectives
This course is designed to give students a good understanding of the various aspects of site investigation/characterization technologies employed in geotechnical and environmental engineering projects. The importance of planning, design and monitoring as well as the variability and uncertainties in geologic materials and formation are emphasized.

Reference Books
Because of the unique nature of this course, no single textbook is required. These are some of the reference books for this course. Additional list of books, papers and reports will be provided during the course.

- "Cone Penetration Testing in Geotechnical Practice" by T. Lunne, P. K. Robertson and J. J. M. Powell, Published by Blackie Academic and Professional, an imprint of Chapman & Hall, 1997.
- "The Pressuremeter" by Jean-Louis Briaud, Published by A. A. Balkema, 1992.
• "Environmental and Engineering Geophysics" by Prem V. Sharma, Published by Cambridge University Press, 1997.

**Instructional Method:** Lecture

**Evaluation and Grading**
Special Term Project 10%
Assignments 25%
Projects & Presentations 25%
Midterm Exam 20%
Final Exam 20%

**Attendance Requirement:** 100%

**Course Content**

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<th>WEEK</th>
<th>SUBJECT</th>
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<td>Introduction, project initiation/planning, and sampling</td>
</tr>
<tr>
<td>2</td>
<td>Drilling, Sampling and Standard Penetration Test</td>
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<td>Labor Day Holiday – no classes</td>
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<td>Cone Penetration Test</td>
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<td>5</td>
<td>Dilatometer and Pressuremeter Test</td>
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<td>6</td>
<td>Vane Shear and Iowa Bore Hole Shear Tests (not before 6:30 PM)</td>
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<td>7</td>
<td>Review of In-situ testing</td>
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<td>8</td>
<td>Student Recess -- no classes</td>
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<td>9</td>
<td>Mid-term Exam</td>
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<td>10</td>
<td>Groundwater monitoring and Permeability</td>
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<td>11</td>
<td>Geophysical Methods I (Gravity, and Magnetic Methods)</td>
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<td>12</td>
<td>Geophysical Methods II (Seismic, and Electrical Resistivity Methods)</td>
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<td>13</td>
<td>Geophysical Methods III (Ground Penetrating Radar Methods)</td>
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<td>Uncertainty in the Geologic Environment.</td>
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<td>Exam 2</td>
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<td>Reading day</td>
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<td>17</td>
<td>Project presentation and submission</td>
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General
No extra credit assignments will be given under any circumstance.
No makeup exams will be given except when proper notification or excuse provided before the exam.
Concern about quiz grading should be expressed in writing and turned in with the quiz for consideration.
Students are expected to familiarize themselves with and observe the requirements of the UNC Charlotte Code of Student Academic Integrity (latest version). The full code is available online at http://www.uncc.edu/policystudent/ps-105.html
CEGR 6125 Structural Strengthening

Proposed and to be taught by:
Dr. Janos Gergely, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description
CEGR 6125. Structural Strengthening. (3) Prerequisite: CEGR 3221 – Structural Steel Design I and CEGR 3225 – Reinforced Concrete Design I, with a grade C or better, graduate student status. Code requirements for the evaluation of existing structures; analysis of existing structures; performance based design of buildings and bridges; strengthening/retrofit techniques for concrete, structural steel, masonry and timber elements, such as beams, columns, shear/bearing/retaining walls, and slabs; studies of actual strengthening projects using innovative techniques and materials. (Spring)

# Credit Hours: 3

Frequency: Offered every spring semester

Prerequisites
- CEGR 3225 - Reinforced Concrete Design I (and second course strongly recommended)
- CEGR 3221 - Structural Steel Design I (and second course strongly recommended)
- Would be beneficial to have some of these classes: masonry/bridge/timber design, FE, dynamics, NDE!

Course Objectives
This graduate level class will provide information on the analysis of structures, and the design of strengthening/retrofit/repair techniques for concrete, structural steel, masonry and timber elements, such as beams, columns, shear/bearing/retaining walls, slabs, etc... Furthermore, this class will also provide, through special projects/case studies, experience with the detailed analysis of real structural systems (buildings and bridges), and the design of the strengthening/retrofit/repair measures required to bring the structures up to the required performance level.

Text
- Handouts
- Design/structures textbooks

Codes
- ASCE 7-05, and other model codes

Instruction Method: Lecture
Student Conduct
Students have the responsibility to know and observe the requirements of The UNCC Code of Student Academic Integrity (latest revision). This code forbids cheating, fabrication, or falsification of information, multiple submission of academic work, plagiarism, abuse of academic materials, and complicity in academic dishonesty. Students who violate the code can be expelled from UNCC. The normal penalty for a first offense is zero credit on the work involving dishonesty and further substantial reduction of the course grade. In almost all cases, the course grade is reduced to “F”. Copies of the code can be obtained from the Dean of Student Office. CE Department policy is that ALL instances of suspected cheating be handled according to The UNCC Code of Student Academic Integrity (latest revision).

Project Assignments
Several project assignments will be given throughout the semester. Unless otherwise specified, each problem will be solved individually and using tools available to structural engineers.

Presentation Schedule
Students are expected to attend class regularly and punctually; failure to do so, will result in a lower class grade. A grade zero will be given any student who misses a presentation or project report deadline, unless a valid excuse is presented promptly in writing. Any absence that is predictable should be discussed with the course instructor in advance.

Additional Course Requirements
- Your written work must be neatly presented and easily followed.
- When a textbook or design code is utilized to obtain any data, the page number, table number, and/or equation number must be appropriately referenced.
- Dimensioning should use standard engineering graphics procedures. Units are very important – show units on all intermediate answers as well as the final answer.

Course Grading
Course Grade: (A=90-100, B=80-89, C=70-79, D=60-69, F=<60). Grade can be roughly estimated from the following:
- Reports.............60%
- Presentations.....40%

Course Outline
- Introduction
- Building code requirements
- Building systems
- Bridge systems
- Seismic performance levels
- Structural assessment
- Beam strengthening techniques
- Column strengthening techniques
- Slab and wall strengthening techniques
- Advanced computational methods
CEGR 6162 Computer Applications for Transportation Engineers

Proposed and to be taught by:
Dr. Srinivas S. Pulugurtha, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description
CEGR 6162. Computer Applications for Transportation Engineers. (3). Prerequisites: CEGR 3161 – Introduction to Transportation Engineering or consent of the instructor, graduate student status. Apply analytical techniques using traffic simulation and transportation planning software to evaluate various transportation facilities; Emphasis on computer applications and software packages such as HCS, SYNCHRO/SimTraffic, and VISSIM; 4-Step planning process using TransCAD; Build mathematical models. (Spring, alternate years)

# Credit Hours: 3

Frequency: Offered alternate spring semester

Course Objectives
The objectives of the course are to:
1. Educate students to better understand how to evaluate traffic facilities using appropriate method and simulation software,
2. Develop skill sets to address existing transportation problems by recognizing failure of a traffic facility, selecting suitable alternatives, and conducting economic analysis, and
3. Experience team-work in design, analysis, and presentation of project outcomes.

By the end of the course, students are expected to:
1. Have an understanding of features and capabilities of various transportation related software,
2. Have skills to analyze and address transportation engineering/planning problems using HCS, SYNCHRO/SimTraffic, VISSIM, and, TransCAD, and
3. Recognize the need and importance for continued learning of traffic simulation software throughout their career.

Reference Material

Prerequisite: CEGR 3161 -- Introduction to Transportation Engineering or consent of the instructor, graduate student status

Grading
Biweekly Assignments/Mini-projects 40%
Term Project 60% (Written report and in-class oral presentation)
100%
Instruction Method: Lecture / Lab

Course Outline
1. Introduction
2. Highway Capacity Software (HCS)
   a. Basic freeway sections
   b. Ramps, weaving sections
   c. Highways and two-lane rural roads
   d. Intersection (pre-timed and actuated)
3. CORSIM
   a. Freeway sections
   b. Intersections analysis and simulation
4. SYNCHRO/SimTraffic
   a. Freeways
   b. Intersection (signalized intersection, roundabout)
   c. Small transportation network
5. VISSIM
   a. Freeways
   b. Intersection (signalized intersection, roundabout)
   c. Small transportation network
   d. Rail-road crossing (use of detectors; transit)
6. Trip generation software and 4-step planning process using TransCAD
7. Build mathematical models

Class Attendance
Students are expected to attend all class meetings for the course. Any missed attendance should receive prior authorization from the instructor except under extenuating circumstances. It is the student's responsibility to obtain information pertaining to class discussions, announcements made, lecture notes or handouts distributed during any missed session(s) - please make arrangements with your classmates. Students with unauthorized absences from class meetings risk having their final score for the course dropped by 0.5 points for every unauthorized absence from class meetings.

Turn off all cellular phones, beepers, etc. that make audible sounds when in class. If you are expecting an EXTREMELY URGENT call or signal, please have the courtesy to discuss the same with the instructor and other students prior to the start of the class session and obtain the instructor's permission to leave your communication device turned on for the duration of that class session.

Refrain from coming late, leaving in the middle of the class, walking in and out of the classroom during the class, or eating in the class since it tends to distract others in the room. If you have to eat for health reasons, do without disturbing others and clean up and dispose of any litter you may create while eating at the end of the class period and prior to leaving the class room. Students coming late to the class, leaving in the middle of the class or walking in and out of class
meetings risk having their final score for the course dropped by 0.5 points for every such unauthorized instance.

**Submission of written work**
Document all of your work (assignments, reports, data used for analysis, source of data used, etc.) as completely as possible. Your writing should be as professional in quality as possible. Each question (even if it is a "problem") must be accompanied by at least one sentence summarizing your findings. All pages of an assignment or submission must be stapled together, be in a legible and well-organized format. All submissions must include the following information on the first page:

- Name
- Assignment number or report title
- Date of submission
- Time Spent in Hours

It is better for you to submit whatever work you have completed at the time that the work is due and then submit work that you complete after this time as a late submission (rather than turning all the work as a late submission).

**Honor Code**
All students are expected to follow the honor code - submit only your original work! Students are expected to work individually on their assignments, unless otherwise instructed by the instructor in the assignment description. Students may discuss the assignment problems (interpretation of the questions, procedures to be used, etc.) in groups. Students may use such discussions to better understand the question or alternative methods of addressing the problem. However, the final submission must be the result of the student's individual effort.

Provide proper credit (citations) where appropriate (includes data that you did not collect but gathered from various sources and used in analysis).

The instructor reserves the right to request any information that was used in the analysis but was not documented in submitted assignments or reports.

Penalties for violating standards of academic integrity could be severe and are stated in the "UNC Charlotte Code of Student Academic Integrity".

**Late Submission Policy**
The assignments will be due at the start of the lecture period on the dates specified when they are handed out or distributed electronically. In general, you will have at least 7 days to work on each assignment. Assignments submitted late will be accepted at the discretion of the instructor and would carry penalties (a minimum penalty of 10 percent for one day; penalty increases with the lateness of your submission). Late submissions will not be accepted after solutions have been posted or discussed in the class.
Other UNC Charlotte Policies

Disability
If you have a disability that qualifies you for academic accommodations, provide a letter of accommodation from the Office of Disability Services at the beginning of the semester. The Office of Disability Services is located in Fretwell Building, Room # 230. The phone # is 704-687-4355 (Voice/TTY).

Religious Holidays
Any student missing class or lab work because of observance of religious holidays shall be given an opportunity during the semester to make up missed work. Please notify well in advance (at least a week) of anticipated absences to be assured of this opportunity.

Absences due to Official UNC Charlotte Activity
Students who represent UNC Charlotte at any official extracurricular activity shall have the opportunity to make up assignments, but the student must provide official written notification to the instructor no less than one week prior to missed class(es).
CEGR 6163 GIS for Civil Engineers

Proposed and to be taught by:
Dr. Srinivas S. Pulugurtha, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description
CEGR 6163. GIS for Civil Engineers. (3). Prerequisites: CEGR 2101 – Engineering Drawing, AutoCAD, or consent of the instructor, graduate student status. Apply Geographic Information System (GIS) tools to solve Civil Engineering problems: add layers, label, & symbolize features, create maps in ArcMap, generate tables & spatial databases, address matching, query & join tables, perform spatial overlays, generate buffers, and conduct spatial analysis. Civil Engineering case studies. (Fall, alternate years)

# Credit Hours: 3

Frequency: Offered alternate fall semester

Instruction Method: Lecture / Lab

Course Objectives
The objectives of the course are to:
4. Educate students to gain knowledge and use features available in a GIS software, and,
5. Have students develop skills to solve Civil Engineering problems using GIS.

By the end of the course, students are expected to:
4. Have an understanding of GIS and its capabilities, and
5. Have skills to solve Civil Engineering problems using commercial GIS software such as ArcMap.

Reference Text

Other References
Students are encouraged to consult several transportation books/journals in the library or elsewhere, including (but not limited to) the following:

Prerequisite: CEGR 2101 – Engineering Drawing, AutoCAD, or consent of the instructor, graduate student status.

Grading
Assignments / mini-projects 25%
Exams 25%
Term project 50% (Written report and in-class oral presentation)
100%

Class Attendance
Students are expected to attend all class meetings for the course. Any missed attendance should receive prior authorization from the instructor except under extenuating circumstances. It is the student's responsibility to obtain information pertaining to class discussions, announcements made, lecture notes or handouts distributed during any missed session(s) - please make arrangements with your classmates and check course website for this. Students with unauthorized absences from class meetings risk having their final score for the course dropped by 0.5 points for every unauthorized absence from class meetings.

Please turn off all cellular phones, beepers, etc. that make audible sounds when in class. If you are expecting an EXTREMELY URGENT call or signal, please have the courtesy to discuss the same with the instructor and other students prior to the start of the class session and obtain the instructor's permission to leave your communication device turned on for the duration of that class session.

Please refrain from coming late, leaving in the middle of the class, walking in and out of the class room, or eating in the class since it tends to distract others in the room. If you have to eat for health reasons, do without disturbing others and clean up & dispose of any litter you create while eating at the end of the class period and prior to leaving the class room.

Submission of written work
Please document all of your work (assignments, reports, etc.) as completely as possible. Your writing should be as professional in quality as possible. Each question (even if it is a "problem") must be accompanied by at least one sentence summarizing your findings. All pages of an assignment or submission must be stapled together, be in a legible and well-organized format. *Submissions must also include the following information on the first page:*

Name
Assignment number
Date of submission
Time Spent in Hours

It is better for you to submit whatever work you have completed at the time that the work is due and then submit work that you complete after this time as a late submission (rather than turning all the work as a late submission).

Honor Code
All students are expected to follow the honor code - submit only your original work! Students are expected to work individually on their assignments, unless otherwise instructed by the instructor in the assignment description. Students may discuss the assignment problems (interpretation of the questions, procedures to be used, etc.) in groups. Students may use such discussions to better understand the question or alternative methods of addressing the problem.
However, the final submission must be the result of the student’s individual effort. Please be sure to provide proper credit (citations) where appropriate. Penalties for violating standards of academic integrity could be severe and are stated in the “UNC Charlotte Code of Student Academic Integrity”.

Late Submission Policy
The assignments will be due at the start of the lecture period on the dates specified when they are handed out or posted on the course website. In general, you will have at least 7 days to work on each assignment. Assignments submitted late will be accepted at the discretion of the instructor and would carry penalties (a minimum penalty of 10 percent for one day; penalty increases with the lateness of your submission). Late submissions will not be accepted after solutions have been posted or discussed in class.

Other UNC Charlotte Policies
Disability
If you have a disability that qualifies you for academic accommodations, please provide a letter of accommodation from the Office of Disability Services in the beginning of the semester. The Office of Disability Services is located in Fretwell Building, Room # 230. The phone # is 704-687-4355 (Voice/TTY).

Religious Holidays
Any student missing class or lab work because of observance of religious holidays shall be given an opportunity during the semester to make up missed work. Please notify your instructor of anticipated absences at least one week in advance to be assured of this opportunity.

Absences due to Official UNC Charlotte Activity
Students who represent UNC Charlotte at any official extracurricular activity shall have the opportunity to make up assignments, but the student must provide official written notification to the instructor no less than one week prior to missed class(es).

Course Outline
1. Introduction
2. Recap of basic GIS concepts
   a. Layers and features
   b. Creating Maps (symbols, labels, legend, scale bar, and north arrow)
   c. Building geodatabases
   d. Digitizing and Geocoding or addressmatching
   e. Querying data and joining tables
   f. Conversion and projection
3. Preparing data for Civil Engineering applications
4. Analyzing spatial data for modeling and analysis of Civil Engineering problems
5. Internet mapping applications for engineering project data sharing and management
6. Case study on modeling air quality emissions
7. Case study on identifying high crash locations
8. Case study on extracting data using geospatial methods and develop (crash) prediction models
CEGR 6164 Traffic Safety

Proposed and to be taught by:
Dr. Srinivas S. Palugurtha, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description
CEGR 6164: Traffic Safety. (3). Prerequisites: CEGR 3161 – Introduction to Transportation Engineering or consent of the instructor, graduate student status. Crash data elements and source of data; Quantifying risk; Crash site reconstruction; Safety evaluation process: Problem definition, high crash locations, ranking and prioritization, understanding causal factors, countermeasure selection, before-after evaluation; Crash prediction Modeling; Economic appraisal; Safety conscious planning. (Fall, alternate years)

# Credit Hours: 3

Frequency: Offered alternate fall semester

Instruction Method: Lecture

Course Objectives
The objectives of the course are to:
6. educate students about the importance of traffic safety, and,
7. have students develop skills to address safety problems using analytical tools and techniques.

By the end of the course, students are expected to:
6. have an understanding of safety issues,
7. knowledge of crash data elements,
8. have skills to identify safety problems, high crash zones/locations, and potential safety countermeasures,
9. rank and prioritize high crash zones/locations, and,
10. be able to evaluate the effectiveness of safety improvement projects.

Selected References
Prerequisite: CEGR 3161 – Introduction to Transportation Engineering or consent of the instructor, graduate student status.

Grading
Assignments 20%
Exams / Field Studies 20%
Term Project 60% (Written report and in-class oral presentation)
100%

Course Outline
1. Introduction
2. Safety, crash, and types of crashes
3. Categories of crashes
4. Measurement of risk - metrics
5. Road design standards
6. Vehicle related characteristics
   a. Mass and size
   b. Occupant protection devices
7. Human factors - Driver related characteristics
   a. Gender and age
   b. Performance and behavior
   c. Contributing factors and collision types
   d. Temporal and spatial distributions
8. Human factors - Pedestrian related characteristics
   a. Gender and age
   b. Pedestrian action
   c. Temporal and spatial distributions
9. Data elements and sources
   a. Who are involved in crashes?
   b. Where (spatial distributions) are crashes occurring?
   c. What are the contributing factors?
   d. What are the collision types?
   e. When (temporal variations) are they occurring?
10. Crash site reconstruction (forensic engineering)
11. Identify problem areas and hazardous locations
12. Measurement of risk, ranking and prioritization
13. Crash prediction and modeling
14. Treatments and countermeasures
15. Evaluation of safety treatments and countermeasures
16. Other topics (safety conscious planning, road audits, …)

Class Attendance
Students are expected to attend all class meetings for the course. Any missed attendance should receive prior authorization from the instructor except under extenuating circumstances. It is the student's responsibility to obtain information pertaining to class discussions, announcements made, lecture notes or handouts distributed during any missed session(s) - please make
arrangements with your classmates. Students with unauthorized absences from class meetings risk having their final score for the course dropped by 0.5 points for every unauthorized absence from class meetings.

Turn off all cellular phones, beepers, etc. that make audible sounds when in class. If you are expecting an EXTREMELY URGENT call or signal, please have the professional courtesy to discuss the same with the instructor and other students prior to the start of the class session and obtain the instructor's permission to leave your communication device turned on for the duration of that class session.

Refrain from coming late, leaving in the middle of the class, walking in and out of the classroom during the class, or eating in the class since it tends to distract others in the room. If you have to eat for health reasons, do without disturbing others and clean up and dispose of any litter you may create while eating at the end of the class period and prior to leaving the class room. Students coming late to the class, leaving in the middle of the class or walking in and out of class meetings risk having their final score for the course dropped by 0.5 points for every such unauthorized instance.

Submission of written work
Document all of your work (assignments, reports, data used for analysis, source of data used, etc.) as completely as possible. Your writing should be as professional in quality as possible. Each question (even if it is a “problem”) must be accompanied by at least one sentence summarizing your findings. All pages of an assignment or submission must be stapled together, be in a legible and well-organized format. All submissions must include the following information on the first page:

Name
Assignment number or report title
Date of submission
Time Spent in Hours

It is better for you to submit whatever work you have completed at the time that the work is due and then submit work that you complete after this time as a late submission (rather than turning in all the work as a late submission).

Honor Code
All students are expected to follow the honor code - submit only your original work! Students are expected to work individually on their assignments, unless otherwise instructed by the instructor in the assignment description. Students may discuss the assignment problems (interpretation of the questions, procedures to be used, etc.) in groups. Students may use such discussions to better understand the question or alternative methods of addressing the problem. However, the final submission must be the result of the student's individual effort.

Provide proper credit (citations) where appropriate (includes data that you did not collect but gathered from various sources and used in analysis).
The instructor reserves the right to request any information that was used but was not documented in submitted assignments or reports. Failure to provide such information will have an effect on your course grade.

Penalties for violating standards of academic integrity could be severe and are stated in the "UNC Charlotte Code of Student Academic Integrity".

Late Submission Policy
The assignments will be due at the start of the lecture period on the dates specified when they are handed out or distributed electronically. In general, you will have at least 7 days to work on each assignment. Assignments submitted late will be accepted at the discretion of the instructor and would carry penalties (a minimum penalty of 10 percent for one day; penalty increases with the lateness of your submission). Late submissions will not be accepted after solutions have been posted or discussed in the class.

Other UNC Charlotte Policies
Disability
If you have a disability that qualifies you for academic accommodations, provide a letter of accommodation from the Office of Disability Services at the beginning of the semester. The Office of Disability Services is located in Fretwell Building, Room # 230. The phone # is 704-687-4355 (Voice/TTY).

Religious Holidays
Any student missing class or lab work because of observance of religious holidays shall be given an opportunity during the semester to make up missed work. Please notify well in advance (at least a week) of anticipated absences to be assured of this opportunity.

Absences due to Official UNC Charlotte Activity
Students who represent UNC Charlotte at any official extracurricular activity shall have the opportunity to make up assignments, but the student must provide official written notification to the instructor no less than one week prior to missed class(es).
CFGR 6243 Physical Processes in Environmental Systems

Proposed and to be taught by:
Dr. James Bowen, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description

# Credit Hours: 3

Frequency: Offered every fall semester

Prerequisites: CEGR 3141, CEGR 3143, MATH 2171.

Instruction Method: Lecture

Textbooks and Other Materials
Readings will be taken from several textbooks on material transport in soils, surface waters, and the atmosphere. These texts are listed below.

Grading and Exams
There will be two in-class exams, either in-class or take-home, during the semester and one comprehensive in-class final examination.

Exams = 25%, 30% = 55%
Homeworks = 10%
Final (covers all of class) = 35%
Total = 100%
**Student Conduct**

All materials submitted for grades (e.g. test and final problems, homework assignments) must represent the student's original work. Students may discuss homework problems, including comparing answers. Copying another student's work, or copying a solutions manual is strictly forbidden. It is the responsibility of every student to know and observe the requirements of the UNCC Code of Student Academic Integrity. This code forbids cheating, fabrication or falsification of information, multiple submissions of academic work, plagiarism, abuse of academic materials, and complicity in academic dishonesty. Any student violating the code will be subject to the penalties described in this document. If in doubt, please ask before you engage in any activity about which you are unsure.

**UNC Charlotte Academic Integrity Page** Students are responsible for meeting all class deadlines (e.g. completing homework assignments, taking tests and finals). No make-up exams are scheduled except for very special situations. Students must appear at the designated time to take in-class tests and finals to receive any credit, unless prior approval is granted for an alternate time. You will not be granted alternate test or final times afterwards.

### Course Outline and Schedule

<table>
<thead>
<tr>
<th>Homework</th>
<th>Class</th>
<th>Topics</th>
<th>Reading Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Class Introduction, Administration, Fluid Movement Processes in Soil, Water, Air 1, Introduction</td>
<td>Streeter, Wylie, Bedford (SWB), Ch. 4.1, pp. 185-195, Bird, Stewart, Lightfoot (BSL), pp. 71-74</td>
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<tr>
<td>3</td>
<td></td>
<td>Fluid Movement Processes in Soil, Water, Air 3, Mass Balances Differential Approach 1/2</td>
<td>Fetter, Ch. 4</td>
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<td>4</td>
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<td>Fluid Movement Processes in Soil, Water, Air 4, Mass Balances Differential Approach 2/2</td>
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<tr>
<td>Hwk. 1 due</td>
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<td>Fluid Movement Processes in Soil, Water, Air 5, Momentum Balance 1/2</td>
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<td>Fluid Movement Processes in Soil, Water, Air 7, Energy Balance</td>
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<td>8</td>
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<td>Fluid Movement Processes in Soil, Water, Air 8, Groundwater Flow 1/2</td>
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<td>Hwk. 2 due</td>
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<td>Fluid Movement Processes in Soil, Water, Air 9, Groundwater Flow 2/2</td>
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<td>Advection-Diffusion Equations in Soil, Water Air 1</td>
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<td>Hwk. 3 due</td>
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<td>Advection-Diffusion Equations in Soil Water, Air 2</td>
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<td><strong>Test 1, Lectures 1 – 9</strong></td>
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<td>12</td>
<td>Diffusion Processes in Groundwater 1</td>
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<td>Turbulent Diffusion in Water, Air 1</td>
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<td></td>
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<td>JB out of town, no class</td>
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<td>15</td>
<td>Shear Dispersion in Water, Air 1</td>
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<td>16</td>
<td>Shear Dispersion in Water, Air 2</td>
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<td>Hwk. 5 due</td>
<td>17</td>
<td>Transport Across Air/Water Interface 1</td>
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<td>18</td>
<td>Transport Across Air/Water Interface 2</td>
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<td><strong>Test 2, Classes 10-16</strong></td>
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<td>19</td>
<td>Settling and Resuspension of Particles 1</td>
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<td>20</td>
<td>Settling and Resuspension of Particles 2</td>
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<td>Hwk. 6 due</td>
<td>21</td>
<td>Transport Measurement Methods in Soil, Water, Air 1</td>
<td></td>
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<td>22</td>
<td>Transport Measurement Methods in Soil, Water, Air 2</td>
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<td></td>
<td>23</td>
<td>Transport Measurement Methods in Soil, Water, Air 3</td>
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<td>24</td>
<td>Transport Measurement Methods in Soil, Water, Air 4</td>
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<td>Hwk. 7 due</td>
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<td>Review</td>
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<td><strong>Final</strong></td>
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CEGR 6244 Chemical Fate and Transport

Proposed and to be taught by:
Dr. John Daniels, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description
CEGR 6244: Chemical Fate and Transport. (3). Prerequisites: CEGR 3141 – Environmental Engineering I, graduate student status. Fate of chemicals in the environment and transport processes within and between phases; Environmental chemodynamics; Volatilization, dissolution and adsorption from an equilibrium perspective; Evaluation of mass transfer kinetics across environmental compartments. (On demand)

# Credit Hours: 3

Frequency: On demand.

Prerequisites: CEGR 3141 – Environmental Engineering I, graduate student status.

Instruction Method: Lecture

Textbooks and Other Materials

Grading and Exams
- Exam 1: 30%
- Exam 2: 30%
- Homework: 25%
- Paper Presentation: 15%
- Total = 100%

Course Outline
- Recreations of Natural Streams
- Equilibrium at Environmental Interfaces I
- Equilibrium at Environmental Interfaces II
- Sorption and Diffusion
- Film Theory
- Chemical Exchange: Air and Water I
- Chemical Exchange: Air and Water II
- Chemical Exchange: Sea Surface Slicks
- Chemical Exchange: Water and Earthen Material
- Chemical Exchange: Air and Barthen Material
- Chemical Exchange: Evaporation and Diffusion through Soil Pores
- Fugacity 1 & 2, computer exercise
CEGR 6244 Chemical Fate and Transport

Proposed and to be taught by:
Dr. John Daniels, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description
CEGR 6244: Chemical Fate and Transport. (3). Prerequisites: CEGR 3141 – Environmental Engineering I, graduate student status. Fate of chemicals in the environment and transport processes within and between phases; Environmental chemodynamics; Volatilization, dissolution and adsorption from an equilibrium perspective; Evaluation of mass transfer kinetics across environmental compartments. (On demand)

# Credit Hours: 3

Frequency: On demand.

Prerequisites: CEGR 3141 – Environmental Engineering I, graduate student status.

Instruction Method: Lecture

Textbooks and Other Materials

Grading and Exams

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>30%</td>
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<tr>
<td>Exam 2</td>
<td>30%</td>
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<tr>
<td>Homework</td>
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</tr>
<tr>
<td>Paper Presentation</td>
<td>15%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
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</tbody>
</table>

Course Outline
• Reaccretion of Natural Streams
• Equilibrium at Environmental Interfaces I
• Equilibrium at Environmental Interfaces II
• Sorption and Diffusion
• Film Theory
• Chemical Exchange: Air and Water I
• Chemical Exchange: Air and Water II
• Chemical Exchange: Sea Surface Slicks
• Chemical Exchange: Water and Earthen Material
• Chemical Exchange: Air and Earthen Material
• Chemical Exchange: Evaporation and Diffusion through Soil Pores
• Fugacity 1 & 2, computer exercise
CEGR 6245 Chemical & Biological Processes in Environmental Systems

Proposed and to be taught by:
Dr. James Amburgey, Associate Professor of Civil & Environmental Engineering

Graduate Catalog – Information and Description
CEGR 6245: Chemical and Biological Processes in Environmental Systems. (3) Prerequisites: CHEM 1251, CEGR 3141, graduate student status. Chemical and biological processes that describe the behavior of materials in natural and engineered environmental systems. Chemical processes to be covered may include acid-base reactions, equilibrium partitioning, pH buffering, precipitation/dissolution, complex formation, adsorption, oxidation-reduction, coagulation, and adsorption. Fundamentals of biological theories to be covered may include kinetics, bioenergetics, genetics, and cellular functions. (Fall)

# Credit Hours: 3

Frequency: Offered every fall semester

Prerequisites: CHEM 1251, CEGR 3141, graduate student status.

Instruction Method: Lecture

Approach/Philosophy
Many graduate environmental engineering programs (e.g., Georgia Tech) begin with all of the students being required to take 3 separate courses in their first semester that cover the FUNDAMENTAL concepts necessary for graduate level research and coursework. One course is physical processes, which covers reactors, reactions, reaction orders, advection, dispersion, diffusion, mass balances, and related physical processes. A second course is chemical processes (or environmental chemistry) which covers ideality, kinetics, thermodynamics, equilibrium, chemical reactions, acid/base behavior, chemical speciation, pC-pH diagrams, the carbonate system (buffering), and related chemical processes. The third course is biological processes (or environmental microbiology), which covers topics like types of microorganisms, their requirements for growth & survival, natural biological cycles (e.g., the carbon cycle), photosynthesis, models to predict the growth & decay of microorganisms, and related biological processes. This course will cover some of the most important topics from 2 of the 3 areas listed previously in a single course. This course will empower you with the fundamental knowledge and skills necessary to for understanding environmental systems & your environment, taking upper level environmental courses, and functioning efficiently in an environmental research laboratory. Of course, physical, chemical, and biological process principles apply to & control almost every system in the world.

Course Text:
Other Potential Resources:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Percent of Course Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>10</td>
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<tr>
<td>Project(s)</td>
<td>10</td>
</tr>
<tr>
<td>Exam #1</td>
<td>25</td>
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<tr>
<td>Exam #2</td>
<td>25</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30</td>
</tr>
</tbody>
</table>

Expectations
I have some expectations of you that go beyond the obvious things like turning in homework, and I thought it would be useful to make these explicit also. The first expectation is that you are curious. I will ask lots of questions in this class and I hope and expect you to do the same. My second expectation is that you, individually and as a group, will be both learners and teachers. I want you to learn from each other, teach each other, and teach me. My third expectation is that you come to class prepared!

Course Outline

<table>
<thead>
<tr>
<th>Subject</th>
<th>Assignments/Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction &amp; Overview</td>
<td>Read Pgs. 1-9</td>
</tr>
<tr>
<td>2. Manipulating units, concentrations in liquid &amp; air, and the ideal gas law</td>
<td>Read Pgs. 11-20</td>
</tr>
<tr>
<td>3. Molarity, Normality &amp; Equivalent units</td>
<td>Read Pgs. 21-36</td>
</tr>
<tr>
<td>4. CHEM1: Ideality, activity, ionic strength</td>
<td>Read Pgs. 43-48</td>
</tr>
<tr>
<td>5. CHEM2: Kinetics &amp; (0 &amp; 1st order) Reaction Rates</td>
<td>Read Pgs. 49-56</td>
</tr>
<tr>
<td>6. CHEM3: Kinetics Applications</td>
<td>Read Pgs. 49-56</td>
</tr>
<tr>
<td>7. CHEM4: Half-life, temperature effects, and catalysts</td>
<td>Read Pgs. 57-62</td>
</tr>
<tr>
<td>8. CHEM5: Thermodynamics (free energy) &amp; Equilibrium</td>
<td>Read Pgs. 63-75</td>
</tr>
<tr>
<td>9. CHEM LAB1: Tea Time (Thermodynamics/Kinetics)</td>
<td>Read Pgs. 76-85</td>
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<tr>
<td>11. CHEM7: Acid-Base Chemistry (pH &amp; Equilib. Consts.)</td>
<td>Read Pgs. 93-102</td>
</tr>
<tr>
<td>12. CHEM8: Carbonate system, alkalinity, &amp; Buffering</td>
<td>*Read paper</td>
</tr>
<tr>
<td>13. CHEM LAB2: pH measurement</td>
<td>Read Pgs. 103-120</td>
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<tr>
<td>16. CHEM9: Solubility, Sorption &amp; Ion Exchange</td>
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<tr>
<td>17. CHEM10: Oxidation &amp; Reduction (Redox)</td>
<td>Read Pgs. 121-129</td>
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<tr>
<td>18. BIOL1: tentative: Ecosystems &amp; Microorganisms</td>
<td>Read Pgs. 209-217</td>
</tr>
<tr>
<td>19. BIOL2: tentative: Population Dynamics &amp; Growth</td>
<td>Read Pgs. 217-224</td>
</tr>
<tr>
<td>20. BIOL3: tentative: Monod model</td>
<td>Read Pgs. 224-236</td>
</tr>
<tr>
<td>22. BIOL5: tentative: Oxygen Demand (DO, BOD, COD...)</td>
<td>Read Pgs. 248-273</td>
</tr>
<tr>
<td>24. BIOL7: tentative: Lakes, nutrients, &amp; Eutrophication</td>
<td>Read Pgs. 291-300</td>
</tr>
<tr>
<td>25. BIOL8: tentative: Health &amp; Welfare: toxicity &amp; indicators</td>
<td>Read Pgs. 300-310</td>
</tr>
</tbody>
</table>

**Homework**

Homework is due at the beginning of the 2nd class period after it is assigned (unless otherwise noted). Homework must be handed in at the beginning of class and late homework will not be accepted (without a prior agreement).

Learning is the principal objective of any course. I expect to learn a lot this semester from you, I expect (hope) you to learn from me, and I expect you to learn from each other. Because of the latter expectation, I have no objections to people working together in small groups (2 or 3 people), **provided it is a mutual learning experience for all involved**.

Direct copying of another's work is not allowed, nor is dividing an assignment two or three ways and exchanging papers later. If one person has already solved a problem, and you have put in a good-faith effort on it but still cannot solve it, it is acceptable for that person to teach you how to solve it, but not acceptable for him to simply give you his/her paper as a guide.

**Academic integrity violations, including plagiarism:** All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at:


**IF YOU HAVE ANY QUESTIONS ABOUT WHAT IS OR IS NOT ACCEPTABLE FOR THIS COURSE, THEN PLEASE SEE THE INSTRUCTOR BEFORE TURNING IN YOUR WORK.** The policy on cheating is no tolerance & no second chances. **Whenever you legitimately use the work, ideas, or help of others, please document it on the submitted assignment.**

**Use of cell phones, beepers, or other communication devices in the classroom:** Please put all electronic devices in "silent" or "vibrate" mode prior to entering the classroom. The use of cell phones, beepers, or other communication devices during class is disruptive, and is therefore prohibited. In case of an emergency, those using such devices must leave the classroom.
Attendance
Class attendance is not required, but failure to attend class could be hazardous to your learning experience. So, please arrive on time and be prepared to participate in class.

Orderly and productive classroom conduct: I will conduct this class in an atmosphere of mutual respect. I encourage your active participation in class discussions. Each of us may have strongly differing opinions on the various topics of class discussions. The conflict of ideas is encouraged and welcome. The orderly questioning of the ideas of others, including mine, is similarly welcome. However, I will exercise my responsibility to manage the discussions so that ideas and argument can proceed in an orderly fashion. You should expect that if your conduct during class discussions seriously disrupts the atmosphere of mutual respect I expect in this class, you will not be permitted to participate further.

Makeup work: Makeup assignments or exams will not be given, unless a prior agreement is reached between the student and the instructor.

Agreement to terms and conditions set forth herein: If you do not agree to these terms and conditions, then you risk losing the opportunity to participate in this course. Please contact the instructor immediately or withdraw from this course if you do NOT agree to the terms and conditions of this syllabus.