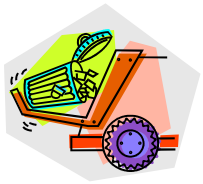

Landfill Design

Instructor: **Prof. Milind V. Khire, Ph.D., P.E.**

Office Address: 3260 EPIC, Ph: (704) 687-0069
email: mkhire@uncc.edu

Class Time/Location: Tue, 6:30 to 9 PM, TBA

Make up Classes: As part of my job responsibilities related research and professional service, I do travel. If I am traveling and I am out of town during the days when I teach the class, I may either find a substitute instructor or cancel the class. If I have to cancel the class, I will make up the class by starting subsequent classe(s) as early as 4:00 PM and/or extending the class(s) till 7:30 PM. I will do my best to accommodate your schedule.

Office Hours: M – 11 to 12 PM and Tue – 5 to 630 PM

Prerequisite(s): None. Even if the instructor has waived the prerequisite(s), you shall take full responsibility for your performance in this course.

Required Text Book: **None**

Reference Books:

- *Geotechnical Aspects of Landfill Design……..Qian et al.* (Prentice Hall)
- *Hazardous Waste Management,* 2nd Edition, MD LaGrega, PL Buckingham and JC Evans, McGraw-Hill, 2001.
- *Integrated Solid Waste Management* by Tchobanoglous/Theisen/Vigil; Publisher: McGraw Hill

Grading Assistant:

A student may be assigned to grade your homework, quizzes, and selective questions in your exams.

Introduction:

Geoenvironmental engineers routinely work on civil engineering projects having environmental implications. For example, geoenvironmental engineers often work on design, permitting, operation, and legal aspects of municipal solid waste landfills, hazardous waste landfills, agricultural waste, and investigation and cleanup of contaminated sites. This course will teach you basic and design-level geoenvironmental engineering concepts.

In this course, you will learn the fundamental principles and key technologies that are used to manage municipal, commercial, and industrial solid waste that is generated in the United States. Almost all waste on this planet is created by humans as we enjoy our lifestyle. Industrialization has contributed to significant increases in the annual waste generation volumes while recycling and reuse is partially offsetting that increase.

In order to manage the waste economically and to comply with environmental regulations, specialized training and experience is required. Civil, environmental, chemical, geological and agricultural engineers can benefit from this course.

Student Background:

I assume and hope that the background and interest of students in this class will be quite diverse. Diverse backgrounds will add to the learning process – both yours and mine! I expect the students to have basic knowledge in environmental engineering and soil properties.

Objectives:

It is a 3-credit course. I will attempt to meet the following course learning objectives (CLOs). However, it is possible that I will not be able to meet all CLOs.

1. Identify key sources, typical quantities generated, composition, and properties of solid and hazardous wastes;
2. Identify waste disposal or transformation techniques (landfills and incinerators);
3. Recognize the relevant state and federal regulations and public policy issues that apply for facilities used for disposal, and destruction of waste;
4. Understand siting and permitting process for landfills;
5. Design landfill lining system;
6. Design leachate collection system;
7. Design gas collection system;
8. Identify recycling and reuse options (e.g., composting, source separation, and re-use of fly ash, etc.);
9. Understand the economic factors that affect design of landfill components;
10. Function successfully as part of a 3-4 member team to conduct, analyze and report the solution to a technical project; and
11. Understand the importance of professional licensure (i.e., EIT and PE licenses) and how the subjects covered in this class relate to the professional licensure exams.

Grading Criteria:

Attendance & Participation (1%): Attendance will be randomly recorded. If you missed any class(s) on the days when the attendance is recorded, you will receive a reduced grade proportional to the number of missed classes.

Homework (12%). If not specified, homework will be due a week after it is handed out. Homework must be turned in during the class hour in the classroom on the due date. Late turned in homework will receive a zero grade. You are expected to turn in neat and organized homework. I also would like you to box or underline your summary answers so it is easier to spot them while grading. Any homework which is sloppy, difficult to read, or difficult to understand will receive a reduced grade.

Quizzes (12%). 5 to 8 in-lecture quizzes (5 to 20 min duration) will be given throughout the semester. These quizzes maybe given without any notice (spontaneously). Each quiz will include basic material covered in the class during the previous four weeks. Under no circumstances you will be allowed to make up any missed quizzes.

Exams (30%): Two exams (15% total grade per exam) will be given during the semester. Students should plan their schedules around these times. These dates will be confirmed up to 1 week prior to the exams. It is your responsibility to attend the class and record any schedule deviations. You can re-schedule the class exam times only by obtaining consent of the instructor at least 2 working days before the exam. If you are sick, you can re-schedule the exams only by providing a registered doctor's certificate within a week after the missed exam or when you attend the next class, whichever comes first.

Project (20%): To be discussed after the 1st Exam.

Final Exam (25%): A final exam worth 25% of the total grade will be given at the end of the semester. The final exam would cover the entire syllabus (comprehensive).

Misc Rule:

You must collect graded material during the class hours during the week it is handed out in the class. After that, you will need to stop by the instructor's office to pick up your graded material before the end of the semester. After that, I will assume that you have waived your right to access your graded material.

Grading Scale:

Total Score	Grade Point	Total Score	Grade Point
≥ 90	4.0	< 60	0.0
≥ 80 to < 90	3.0		
≥ 70 to < 80	2.0		
≥ 60 to < 70	1.0		

Notes: 1. I may translate the grading scheme by statistical curving (linear or non linear) to reflect the true class average.
2. For all written graded assignments, you may or maynot receive partial credit for incorrect answer(s). For comprehensive problems, correct answers without supporting

steps/equations used to calculate the answer will not be given full credit. If partial credit is contested, the entire assignment will be regraded. In that case, your grade may go up, remain unchanged or go down.

3. The instructor reserves the right to make borderline decisions based on the student's motivation, attendance, and participation in the class, and the quality of work.

Other Important Notes:

Missing Class to Participate in a Required Activity or Religious Observance: To be excused from this class to participate in a required activity for another course, a university-sanctioned event, or a religious event, you must provide the instructor with advanced notice and, when applicable, a written authorization from the faculty member of the other course or from a university administrator.

Amendments:

If we together agree to make any changes to this syllabus including grading policies, we will note down the amendments in this section.

1.

Tentative Topic Schedule for CE485 (may be revised)

Week	Topic
1	Sources, quantities generated, and physochemical properties of municipal solid waste and hazardous waste
2	Solid Waste Management Pyramid – Key Technologies for SWM (collection, handling, transformation, landfills, incinerators, composting)
3	Relevant environmental regulations for waste disposal, site investigations
4	Site investigations, Site Selection (NIMBY), Regulatory permitting process
5	Incineration and composting
6	Types of Landfills, basic geotechnical considerations, earthen liners for waste disposal
7	Clay mineralogy, factors controlling hydraulic conductivity, methods to measure k in the lab and field, compatibility of liner materials to chemicals in leachate
8	Contaminant and liquid Transport in soil liners for RCRA liners (advection and diffusion)
9	Geosynthetics for waste disposal – overview, Geomembranes-leakage, transport, and structural stability, Gesosynthetic Clay Liners (GCLs)
10	Design of Leachate Collection System for Landfills – Use of gravel and GDLs
11	Operational aspects of MSW landfills (daily cover, leachate disposal, GW monitoring)
12	Landfill Gas Collection System and Leachate Recirculation System Design
13	Landfill Final Cap Design and Water Balance (demonstration of HELP Model) Modeling
14	Review Problems
15	Review Problems