

**Course Syllabus for
BAE 590-601: DRAINMOD
Spring 2011**

Course Prefix and Title:

BAE 590-601: DRAINMOD

Number of Credits:

3 semester hours

Course Prerequisites/Co-requisites:

Good background in soil water processes, hydraulics or soil physics.

Meeting Time:

No formal class meetings. Lectures delivered online.

Class Location:

Internet

Course Website and Discussion Board:

<http://moodle.wolfware.ncsu.edu/> (NCSU Unity ID required to login)

Instructor Information:

Name: Dr. Wayne Skaggs

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Office location: 150 Weaver Labs, Box 7625 Raleigh, NC 27695-7625

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Co-Instructor: Mr. Brian Phillips
 Research Associate and PhD Student
 182 Weaver Labs
 Campus Box 7625
 Raleigh, NC 27695-7625
 brian_phillips@ncsu.edu

Office Hours: Office hours are available upon email request.

Required Course Materials:

Theory of Drainage by Dr. Wayne Skaggs. *Available at NCSU Bookstore.*

DRAINMOD Course Binder. *Available at NCSU Bookstore.*

DRAINMOD 6.1 Software. *Available for download through the course website.*

Other handouts to be provided as semester progresses and will be available for download through the course website.

Course Objectives:

The goal of the course is to present the principles of water movement and fate in shallow water table systems and to use those principles in the application of the drainage/water management model DRAINMOD to a wide range of problems. The theory of water movement in both the saturated and unsaturated states is applied to characterize processes such as drainage, infiltration, upward water movement from the water table to supply ET, and seepage. These theories are used to develop inputs for DRAINMOD. The model is applied to solve problems related to evaluation, design and management of poorly drained soils, as well as to wetland hydrology. DRAINMOD simulates the day-by-day hydrology and/or performance of drainage and related water management systems. In addition to learning the theory of the model and how to apply it to solve a variety of drainage and water management problems, the student will learn how to estimate model inputs when field data are incomplete and the use of sensitivity analyses to determine which inputs are most critical.

The course is taught by lectures on the application of principles of saturated and unsaturated flow to describe important hydrologic processes for shallow water table soils. A series of 13 problems sets are assigned to demonstrate how inputs to the model are determined, and how the model may be applied to describe the complex interactions of multiple processes affecting the hydrology of shallow water table soils. The projects include application of the model to describe wetland hydrology; effect of drainage design on trafficability of a construction site; design of a drainage system to optimize crop yields and profits; analysis and design of controlled drainage and subirrigation systems; effect of drainage design on nitrogen losses; drainage for salinity control; effect of drainage design on volume of waste water that can be treated by land application; and drainage design to permit on-site waste water treatment; and modeling the performance of storm water bioretention areas. Application of the model is demonstrated for each major problem area.

Additional Course Requirements:

Students will need a computer capable of running DRAINMOD 6.0 (OS - XP / Vista / Windows 7, .NET framework 4). Internet Explorer or Firefox is required to properly view video lectures. Microsoft Office, Open Office, LibreOffice or similar is required for writing reports. Access to a scanner is required for HW1. Adobe Acrobat or similar is required for viewing PDF documents. Other recommended software will be listed on the course website.

Student Responsibilities and Class Attendance:

As a distance learning student, formal attendance is not required. However all assignments and activities are expected to be completed on time. Extensions of due dates will include cases covered by University policy (illness, death in family, etc.). Contact the instructor prior to absences if possible. See the [University policy for absences](#).

Assignments:

Assignments are listed below along with their total percent value toward final grade.

Homework: 60-70%

Midterm and Final Exam: 30-40%

Homework and Exams:

Homework assignments will be posted on the course web page. Due dates and times will be listed on the assignment.

There will be a specific report format for *most* homework assignments. A template will be provided to you. **Failure to follow the format will result in a 0 for that assignment.**

All HW submissions must be made via the course website.

Unless noted Otherwise, Report Based HW submissions must include the following when applicable.

- Report in Microsoft Word or OpenOffice Writer or LibreOffice Writer format
- Spreadsheet in Microsoft Excel or OpenOffice Calc or LibreOffice Calc format
- DRAINMOD input files (/inputs, /soils, /crops, /weather, etc...) related to HW
- PDF copies of any additional reference materials not presented in the class.

Do Not submit a report in PDF format. This is due to the grading methodology and is no reflection on PDF's.

Do your own work. You may collaborate on HW assignments only, not exams. But, the HW you turn in must be your own work. If two or more students turn in an identical HW (even just identical sections), those students will receive 0 points for the assignment.

Exam work must be your own and a signature on the exam is an affirmation of such.

All Exam submissions must be made via the course website.

Required files and format to be turned in for each exam will be listed on the exam.

Late Assignments and Incomplete Grades:

Late Exams will not be accepted. Ample time will be given to complete an exam.

Late Homework will be penalized at a rate of 5% of maximum possible points per day for up to 2 days.

Without prior approval, you will receive 0 points for any homework assignment more than 2 days late (Typically the Sunday after the original due date).

If by some circumstance you get behind in your coursework, you can request in writing that you be given an incomplete as a final course grade. Your request should state the reason(s) for needing an incomplete grade, and it must be submitted no later than the last day of classes. You are also required to set up an appointment with the instructor to discuss your request. The Handbook for Advising and Teaching (2002) states, “At the discretion of the instructor, students may be given an incomplete grade for work not completed because of a serious interruption in their work not caused by their own negligence.”

Academic Integrity:

Please do not cheat. Students are bound by the academic integrity policy as stated in the code of student conduct. Therefore, students are required to uphold the university pledge of honor and exercise honesty in completing any assignment. See the website for a full explanation:

http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php

Students With Disabilities:

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653.

http://www.ncsu.edu/provost/offices/affirm_action/dss For more information on NC State's policy on working with students with disabilities, please see http://www.ncsu.edu/policies/academic_affairs/courses_undergrad/REG02.20.1.php

Agenda

Unless noted otherwise, HW assignments released on Monday are due by 5 PM EST on the following Friday.

January 10, 2011

Module 1: Introduction to the course, Objectives and Scope, Introduction to DRAINMOD

Module 2: Statics of soil water in shallow water table soils

Homework Released

- Website HW Submission Test – **Due Sunday January 16 by 11 PM EST**
- HW1 – Due Friday January 21

January 17, 2011

All students will be responsible for watching the modules 3 and 4 during this week

Module 3: Statics of soil water in shallow water table soils (continued)

Module 4: Introduction to DRAINMOD: Summary of inputs and outputs

Homework Released

- HW2 – Due Friday January 28

January 24, 2011

Module 5: DRAINMOD Soil Water Balance including soil water distribution, drainage flux, ET, and upward flux

Module 6: Objective Functions (working days, wetland outputs, about stresses due to wet and dry conditions, yields), Monthly Rankings Feature (MRANK, Sensitivity Analysis, Effect of Seepage)

Homework Released

- HW3 – Due Friday February 4

January 31, 2011

Module 7: Effects of surface drainage, Drainage coefficient

Module 8: Unsaturated soil water property inputs to DRAINMOD, Soil Prep

Homework Released

- HW4 – Due Friday February 11

February 7, 2011

Module 9: Analyzing Wetland Hydrology with DRAINMOD

Module 10: Methods for Determining Wetland Hydrologic Status and Lateral Impact of a Drainage Ditch

Homework Released

- HW5 Problems 1,3,4 – Due Friday February 18
- HW5 Problem 2 - **Due Friday February 25**

February 14, 2011

Module 11: Threshold Method for Wetland Hydrology

Module 12: Weather Data to DRAINMOD Format, Contributing Area Method for Wetland Hydrology (Dr. Chip Chescheir)

Homework Released

- HW6 – Due Friday February 25

February 21, 2011

Module 13: Determining Saturated Hydraulic Conductivity

Module 14: Drainage Intensity and the relationship between drainage flux and water table depth

Additional Video: Auger Hole Field Tests – Recorded Spring 2008

Homework Released

- HW Auger Hole – Due Friday March 4

February 28, 2011

Midterm Exam Posted Sometime This Week

Module 15: Predicting Crop Yield with DRAINMOD (Dr. Robert Evans)

Module 16: Controlled Drainage and Subirrigation

Homework Released

- Midterm – **Due Sunday March 6**
- HW7 – **Due Friday March 18 (Due to Spring Break)**

March 7, 2011

Spring Break Week

No New Material Released This Week

March 14, 2011

Module 17: Analyzing On-Site Wastewater Treatment with DRAINMOD (Dr. Robert Evans)

Module 18: On-Site Wastewater Treatment--Example Problem (Dr. Robert Evans)

Homework Released

- HW8 – Due Friday March 25

March 21, 2011

Module 19: Potential Evapotranspiration (PET) (Dr. Devendra Amatya)

Module 20: Onsite wastewater treatment – continued

Homework Released

- HW PET – Due Friday April 1
- HW9 – **Due Friday April 8**

March 28, 2011

Module 21: Onsite wastewater treatment - continued

Module 22: Onsite wastewater treatment – concluded

Homework Released

- None

April 4, 2011 – Note Modules 25 & 26 will be presented before Modules 23 & 24

Modules 25 and 26: Use of DRAINMOD to simulate performance of storm water detention basins or Bio-retention areas

Homework Released

- HW10 – Due Friday April 15

April 11, 2011

Modules 23 and 24: Nitrogen balance in DRAINMOD (Dr. Mohamed Youssef)

Homework Released

- HW11 – Due Friday April 29

April 18, 2011

Module 27: DRAINMOD for salinity control

Homework Released

- None

April 25, 2011 (Dead Week)

Information on Final Exam Release and Due Dates Posted This Week

Module 28: Summary of course

Homework Released:

- None

May 2, 2011

Final Exam Released May 4 (*Tentative*)

Final Exam Due May 9 (*Tentative*)

NOTE: The instructor reserves the right to modify the agenda. Notification will be given when changes are made to the agenda.