## Term Information

| | |
|---|---|
| **Effective Term** | Spring 2023 |

## General Information

| | |
|---|---|
| **Course Bulletin Listing/Subject Area** | Physics |
| **Fiscal Unit/Academic Org** | Physics - D0684 |
| **College/Academic Group** | Arts and Sciences |
| **Level/Career** | Graduate, Undergraduate |
| **Course Number/Catalog** | 5261 |
| **Course Title** | Environmental Soil Physics |
| **Transcript Abbreviation** | Env Soil Physics |
| **Course Description** | Principally involves the state and transport of water, heat and gas within soil, and the associated soil physical properties. |
| **Semester Credit Hours/Units** | Fixed: 3 |

## Offering Information

| | |
|---|---|
| **Length Of Course** | 14 Week |
| **Flexibly Scheduled Course** | Never |
| **Does any section of this course have a distance education component?** | No |
| **Grading Basis** | Letter Grade |
| **Repeatable** | No |
| **Course Components** | Laboratory, Lecture |
| **Grade Roster Component** | Lecture |
| **Credit Available by Exam** | No |
| **Admission Condition Course** | No |
| **Off Campus** | Never |
| **Campus of Offering** | Columbus |

## Prerequisites and Exclusions

| | |
|---|---|
| **Prerequisites/Corequisites** | |
| **Exclusions** | Not open to students with credit for ENR 5261. |
| **Electronically Enforced** | Yes |

## Cross-Listings

| | |
|---|---|
| **Cross-Listings** | Cross-listed in ENR |

## Subject/CIP Code

| | |
|---|---|
| **Subject/CIP Code** | 40.0801 |
| **Subsidy Level** | Doctoral Course |
| **Intended Rank** | Junior, Senior, Masters, Doctoral |

## Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

## Course Details

**Course goals or learning objectives/outcomes**

- Students will gain working knowledge of soil physical properties and how to manage them to optimize crop growth and minimize environmental problems.

Student will learn methods of evaluating soil physical properties.

**Content Topic List**

- Definition of soil physical properties and processes

  Importance of soil physics to the environment and natural resources

  Mass-volume relationship

  Particle size distribution; Different systems of particle classification

  • Stoke's law
- Soil bulk density by core method, demonstration of clod method, and explanation of other methods

  Soil constituents, organic and inorganic; predominant minerals; composition of organic fraction
- Hydrometer analyses, demonstration of the Pipet method

  Particle shape; surface area; packing arrangement

  Properties of clay faction; surface charge, Zeta potential
- Particle Density

  Soil structure; Aggregation; Formation of organo-mineral complexes; Assessment of soil structure

  Aggregation and tensile strength
- Properties of water: Surface tension; Viscosity; Contact angle; Capillarity

  Porosity and pore size distribution; Classification of pores; Measurement of pore size
- Atterberg’s Limits

  Applications of soil structure; Crusting; Surface seal formationSoil strength; Stress/strain

  Tension table and pF curve
- Soil compaction and consolidation; Boussinesq equation; Machinery and compaction; Root growth

  Consistency; Plasticity; Atterberg’s limits

  Hydrologic cycle; Soil moisture content; Soil water potential
- Soil moisture characteristic curves; Plant-available water; Soil water potential measurement

  Saturated hydraulic conductivity

  Water movement in saturated soil; Different forms of Darcy’s Law
- Water movement in saturated soil: numerical examples

  Water infiltration

  Methods of measuring Ks: merits and limitations
- Water movement in unsaturated soil: (i) K, (ii) D

  Gas diffusivity

  Models of infiltration; Calculations of S, A, I

  Water movement in vapor state diffusion
- Field measurements of aeration using PAS and static chamber

  Soil evaporation and its management

  Soil aeration; Air capacity; Composition of soil air

  Soil evaporation measurement

  Aeration; Gaseous exchange

  Mass flow; Diffusion
- ODR and gaseous

  Soil temperature regime; Heat capacity; Thermal conductivity

- Heat transport in soil; Modeling soil temperature

  Soil temperature measurement

  Soil salinity

**Sought Concurrence** No

## Attachments

- ENR 5261 Environmental Soil Physics Syllabus SP2023.pdf: Syllabus

  *(Syllabus. Owner: Thaler,Lindsey Nicole)*

- ENR5261submission.pdf: The ENR 5261 course request

  *(Other Supporting Documentation. Owner: Thaler,Lindsey Nicole)*

- Curriculum_Map (1).pdf: Curriculum Map

  *(Other Supporting Documentation. Owner: Thaler,Lindsey Nicole)*

## Comments

- I was contacted by Sara Fries (fries.71@osu.edu) in ENR who requested this cross-listing be submitted. *(by Thaler,Lindsey Nicole on 09/02/2022 04:06 PM)*

## Workflow Information

| Status | User(s) | Date/Time | Step |
|---|---|---|---|
| Submitted | Thaler,Lindsey Nicole | 09/02/2022 04:19 PM | Submitted for Approval |
| Approved | Humanic,Thomas John | 09/02/2022 04:23 PM | Unit Approval |
| Approved | Vankeerbergen,Bernadette Chantal | 09/27/2022 02:00 PM | College Approval |
| Pending Approval | Cody,Emily Kathryn<br>Jenkins,Mary Ellen Bigler<br>Hanlin,Deborah Kay<br>Hilty,Michael<br>Vankeerbergen,Bernadette Chantal<br>Steele,Rachel Lea | 09/27/2022 02:00 PM | ASCCAO Approval |

# ENVIRONMENTAL SOIL PHYSICS

ENR 5261 Spring 2023

## Course Information

- **Course times and location:**
  - **Lecture**: Mondays and Wednesdays, 10:20 a.m. – 11:15 a.m., Kottman Hall TBD
  - **Lab**: Thursdays 12:45 p.m. – 2:45 p.m.
- **Credit hours:** 3
- **Mode of delivery:** In person

### Instructors

- **Name:** Rattan Lal
- **Email:** lal.1@osu.edu
- **Phone Number:** 614-292-9069
- **Office location:** 422B Kottman Hall
- **Office hours:** Mondays 1:00 p.m. – 2:00 p.m. or by appointment
- **Preferred means of communication:**
  - My preferred method of communication for questions is **email.**
  - My class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to be sure you receive these messages.
- **Name:** Nandini Trivdedi
- **Email:** Trivedi.15@osu.edu
- **Phone Number:** 614-746-9263
- **Office location:** Physics Research Bldg, 2026
- **Office hours:** TBD, or by appointment
- **Preferred means of communication:**
  - My preferred method of communication for questions is **email.**

- My class-wide communications will be sent through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to be sure you receive these messages.

## Teaching Assistant

- **Name:** Umesh Acharya
- **Email:** acharya.112@osu.edu

## Course Prerequisites

There are no course prerequisites.

Not open to students with credit for Physics 5261.

## Course Description

Principally involves the state and transport of water, heat and gas within soil, and the associated soil physical properties.

The course is designed for undergraduate and graduate students interested in learning basic soil physics and its applications to environment quality and sustainable use of natural resources. The syllabus meets the curriculum needs of students in Soil Sciences, Earth Sciences, Hydrology, Soil Mechanics, Natural Resources, Agricultural Engineering, Horticulture and Crop Sciences, Forestry, Restoration Ecology, and Environmental Sciences. Cross-listed with Physics 5261.

## Learning Outcomes

After completion of this course, students will gain working knowledge of soil physical properties and how to manage them to optimize crop growth and minimize environmental problems. Through field and laboratory practical demonstrations and homework assignments, the student will learn methods of evaluating soil physical properties.

The practical skills to be demonstrated will include the following:

- Assessment of soil compaction and crusting
- Particle size distribution and its measurement
- Soil structure, porosity and pore-size distribution
- Plant-available water reserves
- Water movement within soil and the overland flow
- Soil temperature regime, specific heat

- Aeration, gaseous diffusion, and composition of soil air
- Greenhouse effect and global warming
- Plant-water relations, drought stress
- Soil erosion process and erodibility
- Soil physical quality and plant growth

# How This Course Works

**Mode of delivery:** Lecture and lab meet in person.

Sessions will meet each week on Mondays and Wednesdays from 10:20-11:15 a.m and on Thursdays 12:45-2:45 p.m. for lab. Attendance will be taken at each session, and each student will be expected to actively participate in lecture discussions and labs. While attendance and participation are not graded components of this course, engagement is necessary to be successful.

The rest of your work is found in Carmen and can be completed around your own schedule during the week.

**Pace of activities:** This course is divided into **weekly modules** with reading materials that are released one week ahead of time. Students are expected to keep pace with weekly deadlines but may schedule their efforts freely within that time frame.

**Credit hours and work expectations:** This is a **3 credit-hour course**. According to Ohio State bylaws on instruction (go.osu.edu/credithours), students should expect around 4 hours per week of time spent on direct instruction and laboratory activities (instructor content and Carmen activities, for example) in addition to 5 hours of homework (reading, studying, editing notes, and assignment preparation, for example) to receive a grade of C average.

**Attendance and participation requirements:** Research shows regular participation is one of the highest predictors of success. With that in mind, I have the following expectations for everyone's participation:

- **Weekly lectures and laboratory**: **Required**
  You are expected to attend weekly lectures and actively participate in laboratory sessions. If you have a situation that might cause you to miss an entire week of class, discuss it with me *as soon as possible.*
- **Carmen use**: **At least once per week**
  You are expected to log in to the course in Carmen every week to access readings and assignments. During most weeks you will probably log in many times.

- **Office hours**: **Optional**
  Our office hours are optional.

# Course Materials, Fees and Technologies

## Required Reading Materials

- Lal, R. and M.K. Shukla (2004) Principles of Soil Physics. Marcel Dekker, New York, 716 pp.

## Recommended Reading Materials

- H. Don Scott (2000) Soil Physics: Agricultural and Environmental Applications. Iowa State Univ. Press, 421 pp.
- D. Hillel (1998) Environmental Soil Physics, Academic Press, 770 pp.
- Marshall, T.J., J.W. Holmes, and C.W. Rose (1996) Soil Physics. Third edition, Cambridge University Press, 453 pp.
- Ellis, S. and A. Mellor (1995) Soils and Environment. Routledge, London, 364 pp.
- Black, C.A. (Editor-in-Chief) (1986) Methods of Soil Analysis. Part I. ASA, Madison, WI.
- Hillel, D. (1982) Introduction to Soil Physics. Academic Press, 364 pp.
- Hanks, R.J. and G.L. Ashcroft (1980) Applied Soil Physics. Springer-Verlag.
- Hillel, D. (1980) Applications of Soil Physics. Academic Press, 385 pp.
- Baver, L.D., W.H. Gardner and W.R. Gardner (1972) Soil Physics. John Wiley & Sons, Inc., New York.
- Taylor, S.A. and G.L. Ashcroft (1972) Physical edaphology. W.H. Freeman and Co.
- Khonke, Helmut (1968) Soil Physics. McGraw Hill Book Co., New York.
- Rose, C.W. (1966) Agricultural Physics. Pergemon Press, New York.

## Required Equipment

- **Computer:** current Mac (MacOS) or PC (Windows 10) with high-speed internet connection
- **Webcam:** built-in or external webcam, fully installed and tested
- **Microphone:** built-in laptop or tablet mic or external microphone
- **Other:** a mobile device (smartphone or tablet) to use for BuckeyePass authentication

If you do not have access to the technology you need to succeed in this class, review options for technology and internet access (go.osu.edu/student-tech-access).

# Required Software

**Microsoft Office 365:** All Ohio State students are now eligible for free Microsoft Office 365. Visit the installing Office 365 (go.osu.edu/office365help) help article for full instructions.

# CarmenCanvas Access

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you do each of the following:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device (go.osu.edu/add-device) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes, good for 365 days, that can each be used once.
- Install the Duo Mobile application (go.osu.edu/install-duo) on all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

# Technology Skills Needed for This Course

- Basic computer and web-browsing skills
- Navigating CarmenCanvas (go.osu.edu/canvasstudent)
- CarmenZoom virtual meetings (go.osu.edu/zoom-meetings)
- Recording a slide presentation with audio narration and recording, editing and uploading video (go.osu.edu/video-assignment-guide)

# Technology Support

For help with your password, university email, CarmenCanvas, or any other technology issues, questions or requests, contact the IT Service Desk, which offers 24-hour support, seven days a week.

- **Self Service and Chat**: go.osu.edu/it
- **Phone:** 614-688-4357 (HELP)
- **Email:** servicedesk@osu.edu

# Grading and Faculty Response

## How Your Grade is Calculated

| Assignment Category | Points |
|---|---|
| Homework 1 | 10 (5% of grade) |
| Lab 1 report | 10 (5% of grade) |
| Homework 2 | 10 (5% of grade) |
| Lab 2 report | 10 (5% of grade) |
| Homework 3 | 10 (5% of grade) |
| Lab 3 report | 10 (5% of grade) |
| Homework 4 | 10 (5% of grade) |
| Lab 4 report | 10 (5% of grade) |
| Homework 5 | 10 (5% of grade) |
| Lab 5 report | 10 (5% of grade) |
| Homework 6 | 10 (5% of grade) |
| Lab 6 report | 10 (5% of grade) |
| Homework 7 | 10 (5% of grade) |
| Lab 7 report | 10 (5% of grade) |
| Homework 8 | 10 (5% of grade) |
| Lab 8 report | 10 (5% of grade) |

| | |
|---|---|
| Homework 9 | 10 (5% of grade) |
| Lab 9 report | 10 (5% of grade) |
| Homework 10 | 10 (5% of grade) |
| Lab 10 report | 10 (5% of grade) |

See Course Schedule for due dates.

Undergraduate and graduate students will be held to the same standards and expectations in this course.

# Descriptions of Major Course Assignments

## Homework and Lab Report Assignments

**Description:** Homework consists of problems sets, and they are typically assigned on Mondays and due the following Monday, as marked in the class schedule. There are some weeks where the homework assignment schedule differs, so please pay close attention to the schedule detailed here and on Carmen. The demonstrations in laboratory will be synchronized with the weekly lecture, and corresponding lab reports will be assigned on Thursdays and due the following Thursday, according to the class schedule starting on page 14. Assignments will be submitted to the Carmen dropbox.

**Academic integrity and collaboration:** Your written assignments, including homework sets and practical sets, should be your own original work. In formal assignments, you should follow Chicago style (see chicagomanualofstyle.org or OSU Libraries for Chicago Style resources - https://guides.osu.edu/c.php?g=605168&p=4194384) to cite the ideas and words of any research sources. You are encouraged to ask a trusted person to proofread your assignments before you turn them in but no one else should revise or rewrite your work.

# Late Assignments

Please refer to Carmen for due dates. Due dates are set to help you stay on pace and to allow timely feedback that will help you complete subsequent assignments. Students are expected to make every effort to submit assignments on time. Please contact the instructors as soon as possible if an assignment will be late. Arrangements may be made if you are facing extenuating circumstances such as illness or an emergency. Documentation will be required.

# Instructor Feedback and Response Time

We are providing the following list to give you an idea of my intended availability throughout the course. Remember that you can call 614-688-4357 (HELP) at any time if you have a technical problem.

- **Preferred contact method:** If you have a question, please contact me first through my Ohio State email address. I will reply to emails within **24 hours on days when class is in session at the university**.
- **Class announcements:** I will send all important class-wide messages through the Announcements tool in CarmenCanvas. Please check your notification preferences (go.osu.edu/canvas-notifications) to ensure you receive these messages.
- **Grading and feedback:** For assignments submitted before the due date, I will try to provide feedback and grades within **seven days**. Assignments submitted after the due date may have reduced feedback and grades may take longer to be posted.

# Grading Scale

93–100: A
90–92.9: A-
87–89.9: B+
83–86.9: B
80–82.9: B-
77–79.9: C+
73–76.9: C
70–72.9: C-
67–69.9: D+
60–66.9: D
Below 60: E

# Other Course Policies

## Academic Integrity Policy

See Descriptions of Major Course Assignments for specific guidelines about collaboration and academic integrity in the context of this online class.

### Ohio State's Academic Integrity Policy

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's Code of Student Conduct (studentconduct.osu.edu), and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct.

**If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct.** If COAM determines that you have violated the university's Code of Student Conduct (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.
If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- Committee on Academic Misconduct (go.osu.edu/coam)
- Ten Suggestions for Preserving Academic Integrity (go.osu.edu/ten-suggestions)
- Eight Cardinal Rules of Academic Integrity (go.osu.edu/cardinal-rules)

# Copyright for Instructional Materials

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course. Materials may be given through a link or reference so that students may access them securely through the library.

# Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct

The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Office of Institutional Equity:

1. Online reporting form at equity.osu.edu,
2. Call 614-247-5838 or TTY 614-688-8605,
3. Or Email equity@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Office of Institutional Equity to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member."

# Diversity Statement

The Ohio State University affirms the importance and value of diversity of people and ideas. We believe in creating equitable research opportunities for all students and to providing programs and curricula that allow our students to understand critical societal challenges from diverse perspectives and aspire to use research to promote sustainable solutions for all. We are committed to maintaining an inclusive community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among all members; and encourages each individual to strive to reach their own potential. The Ohio State University does not discriminate on the basis of age, ancestry, color, disability, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, race, religion, sex, gender, sexual orientation, pregnancy, protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment.

To learn more about diversity, equity, and inclusion and for opportunities to get involved, please visit:

- https://odi.osu.edu/
- https://odi.osu.edu/racial-justice-resources
- https://odi.osu.edu/focus-on-racial-justice
- http://mcc.osu.edu/

In addition, this course adheres to **The Principles of Community** adopted by the College of Food, Agricultural, and Environmental Sciences. These principles are located on the Carmen site for this course; and can also be found at https://go.osu.edu/principlesofcommunity. For additional information on Diversity, Equity, and Inclusion in CFAES, contact the CFAES Office for Diversity, Equity, and Inclusion (https://equityandinclusion.cfaes.ohio-state.edu/). If you have been a victim of or a witness to a bias incident, you can report it online and anonymously (if you choose) at https://equity.osu.edu/.

# Your Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing.

If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting

ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th floor of the Younkin Success Center and 10th floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

For students in the College of Food, Agricultural, and Environmental Sciences, David Wirt, wirt.9@osu.edu, is the CFAES embedded mental health counselor on the Columbus campus. To contact David, please call 614-292-5766. Students should mention their affiliation with CFAES if interested in speaking directly with David.

# Accessibility Accommodations for Students with Disabilities

## Requesting Accommodations

The university strives to make all learning experiences as accessible as possible. In light of the current pandemic, students seeking to request COVID-related accommodations may do so through the university's request process, managed by Student Life Disability Services. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: slds@osu.edu; 614-292-3307; slds.osu.edu; 098 Baker Hall, 113 W. 12th Avenue.

## Accessibility of Course Technology

This online course requires use of CarmenCanvas (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations as early as possible.

- CarmenCanvas accessibility (go.osu.edu/canvas-accessibility)
- Streaming audio and video
- CarmenZoom accessibility (go.osu.edu/zoom-accessibility)

# Course Schedule

Refer to the CarmenCanvas course for up-to-date due dates.

| Week | Day | Topics | Assignments and Due Dates |
|---|---|---|---|
| 1 | M | i. Definition of soil physical properties and processes<br>ii. Importance of soil physics to the environment and natural resources<br>iii. Mass-volume relationship | **Reading:** Chapters 1 & 2 (p. 1 – 31) |
| | | | **Assigned: Homework 1** Mass-volume relationship, soils and environment, Chapter 2, Problems 1, 3 (p. 29 – 30) |
| | W | i. Particle size distribution<br>ii. Different systems of particle classification<br>iii. Stoke's law | **Reading:** Chapter 3 (p. 34 – 44) |
| | Th | **Lab 1**: Soil bulk density by core method, demonstration of clod method, and explanation of other methods | **Assigned: Lab 1** report |
| 2 | M | **Martin Luther King Day**<br>**No Class** | |
| | W | i. Soil constituents, organic and inorganic<br>ii. Predominant minerals<br>iii. Composition of organic fraction | **DUE: Homework 1** at 5:00 PM |
| | | | **Reading:** Chapter 3 (p. 77 – 86) |
| | | | **Assigned: Homework 2** Stoke's Law and surface area, Chapter 3, Problems 1, 3, 16 |
| | Th | **Lab 2**: Hydrometer analyses, demonstration of the Pipet method | **DUE: Lab 1** report at 5:00 PM |
| | | | **Assigned: Lab 2** report |

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|---|---|---|---|
| **3** | M | i. Particle shape<br>ii. Surface area<br>iii. Packing arrangement | **Reading:** Chapter 3 (p. 44 – 53, 53 – 77) |
| | W | i. Properties of clay faction<br>ii. Surface charge, Zeta potential | **Reading:** Chapter 3 (p. 52 – 73) |
| | Th | **Lab 3**: Particle Density | **DUE: Lab 2** report at 5:00 PM |
| | | | **Assigned: Lab 3** report |
| **4** | M | Particle density | **DUE: Homework 2** at 5:00 PM |
| | W | i. Soil structure<br>ii. Aggregation<br>iii. Formation of organo-mineral complexes<br>iv. Assessment of soil structure | **Reading:** Chapter 4 (p. 93 – 140) |
| | Th | **Lab 4:** Aggregation and tensile strength | **DUE: Lab 3** report at 5:00 PM |
| | | | **Assigned: Lab 4** report |
| **5** | M | Properties of water<br>i. Surface tension<br>ii. Viscosity<br>iii. Contact angle<br>iv. Capillarity | **Reading:** Chapter 9 (p. 255 – 286) |
| | | | **Assigned: Homework 3**<br>Capillarity, pore size distribution, Chapter 5, Problems 1 (one temp. only), 4 (p. 161) |
| | W | i. Porosity and pore size distribution<br>ii. Classification of pores<br>iii. Measurement of pore size | **Reading:** Chapter 5 (p. 149 – 161) |
| | Th | **Lab 5:** Atterberg's Limits | **DUE: Lab 4** report at 5:00 PM |
| | | | **Assigned: Lab 5** report |

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|---|---|---|---|
| **6** | M | Applications of soil structure<br>i. Crusting<br>ii. Surface seal formation | **DUE: Homework 3** at 5:00 PM<br>**Reading:** Chapter 6 (p. 165 – 185) |
| | W | i. Soil strength<br>ii. Stress/strain | **Reading:** Chapter 7 (p. 189 – 205) |
| | Th | **Lab 6:** Tension table and $p^F$ curve | **DUE: Lab 5** report at 5:00 PM<br>**Assigned: Lab 6** report |
| **7** | M | i. Soil compaction and consolidation<br>ii. Boussinesq equation<br>iii. Machinery and compaction<br>iv. Root growth | **Reading:** Chapter 7 (p. 205 – 224) |
| | W | i. Consistency<br>ii. Plasticity<br>iii. Atterberg's limits | **Reading:** Chapter 8 (p. 231 – 251) |
| | Th | **Lab 7:** Laboratory on $p^F$ curve | |
| **8** | M | i. Hydrologic cycle<br>ii. Soil moisture content<br>iii. Soil water potential | **Reading:** Chapter 10 (p. 287 – 315)<br>**Assigned: Homework 4**<br>Moisture content and potential<br>Chapter 10 (pgs. 314 – 315), Problems 1, 2; Chapter 11 (pg. 351), Problems 10 |
| | W | i. Soil moisture characteristic curves<br>ii. Plant-available water<br>iii. Soil water potential measurement | **Reading:** Chapter 11 (p. 321 – 341) |
| | Th | **Lab 8:** Saturated hydraulic conductivity | **DUE: Lab 6** report at 5:00 PM<br>**Assigned: Lab 7** report<br>**Reading:** Chapter 12 (p. 361 – 377) |

| | | | |
|---|---|---|---|
| 9 | M | i. Water movement in saturated soil<br>ii. Different forms of Darcy's Law | **DUE: Homework 4** at 5:00 PM<br>**Reading:** Chapter 12 (p. 341 – 352)<br>**Assigned: Homework 5**<br>Chapter 12, Problems 3, 6 (p. 377) |
| | W | i. Water movement in saturated soil: numerical examples | **Reading:** Chapter 12 (p. 355 – 361) |
| | Th | **Lab 9:** Water infiltration | **DUE: Lab 7** report 5:00 PM<br>**Assigned: Lab 8** report |
| 10 | | **Spring Break**<br>**No Class** | |
| 11 | M | Methods of measuring $K_s$: merits and limitations | **DUE: Homework 5** at 5:00 PM |
| | W | Water movement in unsaturated soil: (i) $K_\Theta$, (ii) $D_\Theta$ | **Reading:** Chapter 13 (p. 379 – 402)<br>**Reading:** Chapter 12 (p. 405 – 412) |
| | Th | **Lab 10:** Gas diffusivity | **DUE: Lab 8** report at 5:00 PM<br>**Assigned: Lab 9** report<br>**Assigned: Homework 6**<br>Chapter 14, Problems 1, 2, 3 (p. 434 – 435) |
| 11 | M | i. Models of infiltration<br>ii. Calculations of S, A, I | **Reading:** Chapter 14 (p. 412 – 434) |
| | W | i. Water movement in vapor state diffusion | **Reading:** Chapter 15 (p. 439 – 446) |
| | Th | **Lab 11:** Field measurements of aeration using PAS and static chamber | **DUE: Lab 9** report at 5:00 PM<br>**Assigned: Homework 7**<br>Chapter 15, Problems 1 – 2 (p. 463) |

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|---|---|---|---|
| **12** | M | i. Soil evaporation and its management | **DUE: Homework 6** at 5:00 PM<br>**Reading:** Chapter 15 (p. 446 – 460) |
| | W | i. Soil aeration<br>ii. Air capacity<br>iii. Composition of soil air | **DUE: Homework 7** at 5:00 PM<br>**Reading:** Chapter 18 (p. 557 – 569)<br>**Assigned: Homework 8**<br>Soil air, Chapter 18, Problems 1, 3, 5, 7 (p. 594) |
| | Th | **Lab 12:** Soil evaporation measurement | **Assigned: Lab 10** report |
| **13** | M | i. Aeration<br>ii. Gaseous exchange | **Reading:** Chapter 18 (p. 569 – 575) |
| | W | i. Mass flow<br>ii. Diffusion | **Reading:** Chapter 18 (p. 575 – 590) |
| | Th | **Lab 13:** ODR and gaseous | **Assigned: Homework 9**<br>Calculate the weight of $CO_2$ in the atmosphere for $CO_2$ concentration of 400 ppm and 550 ppm |

| | | | |
|---|---|---|---|
| **14** | M | i. Soil temperature regime<br>ii. Heat capacity<br>iii. Thermal conductivity | **DUE: Homework 8** at 5:00 PM<br>**Reading:** Chapter 17 (p. 515 – 530)<br>**Assigned: Homework 10**<br>Soil temperature, Chapter 17, Problems 1, 3, 5 |
| | W | i. Heat transport in soil<br>ii. Modeling soil temperature | **Reading:** Chapter 17 (p. 531 – 545) |
| | Th | **Lab 14:** Soil temperature measurement | **DUE: Lab 10** report at 5:00 PM |
| **15** | M | Soil salinity | **DUE: Homework 9** at 5:00 PM<br>**DUE: Homework 10** at 5:00 PM |

## Term Information

| | |
|---|---|
| **Effective Term** | Spring 2023 |
| ***Previous Value*** | *Spring 2013* |

## Course Change Information

**What change is being proposed? (If more than one, what changes are being proposed?)**

Addition of cross listing in Physics; minor update to learning outcomes and detail added to course topic list

**What is the rationale for the proposed change(s)?**

The course will be team taught between Rattan Lal in ENR and Nandini Trivedi in Physics and will draw students from both disciplines. Topic updates to add additional detail.

**What are the programmatic implications of the proposed change(s)?**

**(e.g. program requirements to be added or removed, changes to be made in available resources, effect on other programs that use the course)?**

n/a

**Is approval of the requrest contingent upon the approval of other course or curricular program request?** No

**Is this a request to withdraw the course?** No

## General Information

| | |
|---|---|
| **Course Bulletin Listing/Subject Area** | Environment & Natural Resource |
| **Fiscal Unit/Academic Org** | Sch of Enviro&Natural Res - D1173 |
| **College/Academic Group** | Food, Agric & Environ Science |
| **Level/Career** | Graduate, Undergraduate |
| **Course Number/Catalog** | 5261 |
| **Course Title** | Environmental Soil Physics |
| **Transcript Abbreviation** | Env Soil Physics |
| **Course Description** | Principally involves the state and transport of water, heat and gas within soil, and the associated soil physical properties. |
| ***Previous Value*** | *Principally involves the state and transport of water, heat and gas within soil, and the associated soil physical properties.*<br>*Sp Sem.* |
| **Semester Credit Hours/Units** | Fixed: 3 |

## Offering Information

| | |
|---|---|
| **Length Of Course** | 14 Week, 12 Week |
| **Flexibly Scheduled Course** | Never |
| **Does any section of this course have a distance education component?** | No |
| **Grading Basis** | Letter Grade |
| **Repeatable** | No |
| **Course Components** | Laboratory, Lecture |
| **Grade Roster Component** | Lecture |
| **Credit Available by Exam** | No |
| **Admission Condition Course** | No |
| **Off Campus** | Never |
| **Campus of Offering** | Columbus |

## Prerequisites and Exclusions

| | |
|---|---|
| **Prerequisites/Corequisites** | |
| **Exclusions** | Not open to students with credit for Physics 5261. |
| ***Previous Value*** | Not open to students with credit for 655 or 671. |
| **Electronically Enforced** | Yes |
| ***Previous Value*** | **No** |

## Cross-Listings

| | |
|---|---|
| **Cross-Listings** | Physics 5261 |
| ***Previous Value*** | |

## Subject/CIP Code

| | |
|---|---|
| **Subject/CIP Code** | 03.0103 |
| **Subsidy Level** | Doctoral Course |
| **Intended Rank** | Senior, Masters, Doctoral, Professional |

## Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors
The course is an elective (for this or other units) or is a service course for other units

## Course Details

**Course goals or learning objectives/outcomes**

- Students will gain working knowledge of soil physical properties and how to manage them to optimize crop growth and minimize environmental problems.
- Student will learn methods of evaluating soil physical properties.

***Previous Value***

- *This course is concerned with the physical aspects of the soil environment that impacts organisms growing within and upon the soil. Thus, the principal focus of the course will be the state and transport of water, heat and gas within soil.*
- *Students will also gain a vision of the dynamic nature of soil moisture, temperature and aeration conditions within in situ soils, and an understanding how soil differences influence the dynamic processes.*

**Content Topic List**

- Definition of soil physical properties and processes
- Importance of soil physics to the environment and natural resources
- Mass-volume relationship
- Particle size distribution; Different systems of particle classification
- Stoke's law
- Soil bulk density by core method, demonstration of clod method, and explanation of other methods
- Soil constituents, organic and inorganicl; predominant minerals; composition of organic fraction
- Hydrometer analyses, demonstration of the Pipet method
- Particle shape; surface area; packing arrangement
- Properties of clay faction; surface charge, Zeta potential
- Particle Density
- Soil structure; Aggregation; Formation of organo-mineral complexes; Assessment of soil structure
- Aggregation and tensile strength
- Properties of water: Surface tension; Viscosity; Contact angle; Capillarity
- Porosity and pore size distribution; Classification of pores; Measurement of pore size
- Atterberg’s Limits
- Applications of soil structure; Crusting; Surface seal formation
- Soil strength; Stress/strain
- Tension table and pF curve
- Soil compaction and consolidation; Boussinesq equation; Machinery and compaction; Root growth
- Consistency; Plasticity; Atterberg’s limits
- Hydrologic cycle; Soil moisture content; Soil water potential
- Soil moisture characteristic curves; Plant-available water; Soil water potential measurement
- Saturated hydraulic conductivity
- Water movement in saturated soil; Different forms of Darcy’s Law
- Water movement in saturated soil: numerical examples
- Water infiltration
- Methods of measuring Ks: merits and limitations
- Water movement in unsaturated soil: (i) K, (ii) D
- Gas diffusivity
- Models of infiltration; Calculations of S, A, I
- Water movement in vapor state diffusion
- Field measurements of aeration using PAS and static chamber
- Soil evaporation and its management
- Soil aeration; Air capacity; Composition of soil air
- Soil evaporation measurement
- Aeration; Gaseous exchange
- Mass flow; Diffusion
- ODR and gaseous
- Soil temperature regime; Heat capacity; Thermal conductivity

- Heat transport in soil; Modeling soil temperature
- Soil temperature measurement
- Soil salinity

***Previous Value***

- *Soil as a Disperse, 3-Phase System*
- *Soil Water Principles*
- *Soil Water Flow*
- *Soil Aeration*
- *Soil Temperature*
- *Field Scale Soil Hydrology*
- *Soil-Plant-Water Relations*

**Sought Concurrence** No

## Attachments

- ENR 5261 Environmental Soil Physics Syllabus SP2023.docx: ENR 5261

*(Syllabus. Owner: Fries,Sara Nicholson)*

## Comments

- Revise as per COAA via email 26 August 2022

Revise as per email message 13 July 2022 *(by Osborne,Jeanne Marie on 08/26/2022 04:49 PM)*

## Workflow Information

| Status | User(s) | Date/Time | Step |
|---|---|---|---|
| Submitted | Fries,Sara Nicholson | 07/11/2022 03:38 PM | Submitted for Approval |
| Revision Requested | Osborne,Jeanne Marie | 07/13/2022 03:22 PM | Unit Approval |
| Submitted | Fries,Sara Nicholson | 07/28/2022 03:09 PM | Submitted for Approval |
| Revision Requested | Osborne,Jeanne Marie | 08/26/2022 04:49 PM | Unit Approval |
| Submitted | Fries,Sara Nicholson | 08/30/2022 01:34 PM | Submitted for Approval |
| Pending Approval | Meadows,Kendyl Ann<br>Osborne,Jeanne Marie<br>Violet,Cynthia Alma | 08/30/2022 01:34 PM | Unit Approval |

| | | Physics Major Program Outcomes | | | | | |
|---|---|---|---|---|---|---|---|
| | | Undergraduate Physics majors aquire a basic mastery of fundamental areas of physics, from classical mechanics, though electromagnetism, and finally to modern physics including quantum mechanics and relativity. | Undergraduate Physics majors develop powerful analytical and problem solving skills in areas involving both physics and mathematics. | Undergraduate Physics majors aquire a basic mastery of experimental physics. | Undergraduate Physics majors acquire a basic mastery of data reduction and error analysis. | Undergraduate Physics majors effectively communicate their physical understanding both professionally and colloquially (orally and in writing). | Undergraduate Physics majors are apprised of and encouraged to participate in academic research, industrial research, and/or outreach activities which are consistent with their interest, ability, and post-graduation plans. |
| required courses | Physics 2095: Physics Seminar | | | | | | 3 |
| | Physics 2300: Mechanics I | 3 | 3 | 1 | | | |
| | Physics 2301: Mechanics II | 3 | 3 | 1 | | | |
| | Physics 3700: Data Analysis Lab | 1 | 3 | 3 | 3 | 3 | 1 |
| | Physics 5400: Electromagnetism | 3 | 3 | | | | |
| | Physics 5500: Quantum Mechanics | 3 | 3 | | | | |
| | Physics 5700: Physics Senior Lab | 2 | 3 | 3 | 3 | 3 | 2 |
| required 3rd lab (choose 1) | Physics 3201: Holography | 2 | 3 | 3 | | 2 | |
| | Physics 4700: Electronics Lab | 2 | 3 | 3 | 2 | 3 | 2 |
| | Physics 5680: Big Data Analytics | 1 | 3 | 2 | 3 | 1 | 2 |
| | Physics 5810: Computational Physics | 1 | 3 | 2 | 2 | 2 | 2 |
| required Physics Elective (choose 1) | Physics 3470: Optics | 2 | 3 | 1 | | | 2 |
| | Physics 5261: Environmental Soil Physics | | 3 | 1 | | | 2 |
| | Physics 5300: Theoretical Mechanics | 3 | 3 | | | | 2 |
| | Physics 5401H: Honors E&M II | 3 | 3 | | | | 2 |
| | Physics 5501: Quantum Mechanics II | 3 | 3 | | | 2 | 2 |
| | Physics 5501H: Honors Quantum Mech. I | 3 | 3 | | | | 2 |
| | Physics 5600: Statistical Mechanics | 3 | 3 | | | | 2 |

Relationship: 1 light, 2 intermediate, 3 high