HOS 6355 – ROOT AND RHIZOSPHERE ECOLOGY

3 CREDITS – ONLINE course with IN-PERSON final exam

Contact Information

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Office hours: Online conferencing via canvas/zoom (by request)

Lectures: Online course. Each week there is a block of content available with specific due dates.

Contacting the Instructor and the Teaching Assistants:

Questions about class materials or content: Please utilize the discussion boards in Canvas for any inquiries regarding class mechanics or content. If you have a question about the class or subject material, chances are others may share the same question. Posting it on the discussion boards allows everyone to view both the question and its answer, similar to raising your hand in a physical class. If you choose to use email for a general class-related question, you will be redirected to post your question on the appropriate board, where it will be addressed. Please refrain from using the discussion boards for questions about specific quiz questions on an open quiz, as this might provide an unfair advantage to those who haven't taken the quiz yet.

Individual Questions, Problems, or Appointments: Please use the email function in Canvas to communicate with the instructor and the TAs during the semester, rather than regular university email, except in emergencies. Email and phone messages delivered on weekdays (M-F) will generally receive a reply within one business day (24 hours). Messages may not be checked between 5:00 pm Friday and 8:00 am Monday. Messages received over the weekend will generally receive a response on Monday. If I and/or the TAs plan to be out of the office or otherwise unavailable, I will post an announcement on the class website.

Questions about Grading: This is quite a large graduate class, and we work as a team to manage the various components. The course TAs handle grading for group project assignments and some quizzes. The TAs are graduate students and apprentice instructors. If you have a question or concern about your discussion post grades, please contact the TAs first. If you have an issue that cannot be resolved with your TAs, your course instructor will be happy to work with you both to reach a satisfactory understanding. For questions about exam grades, please contact your main instructor. For questions about course concepts, including quiz questions, both the instructors and the TAs are ready to help!

Technical Support: If you experience difficulties with accessing components of the site, including lectures, quizzes, or tests, contact the UF Help Desk immediately. If they are unable to resolve your problem, contact the instructor with your help desk ticket number and a description of the problem and steps taken to resolve it. Extensions for due dates will be granted for documented technical problems, as needed.

Course Description: This course aims to provide a comprehensive understanding of the rhizosphere and its unique functioning, involving numerous, strong, and complex interactions among plant roots, soil constituents, and microorganisms. It focuses on current discoveries and achievements in plant root science, presenting and discussing the future challenges that root and rhizosphere research face. Topics covered include root structure and architecture, function, regulation, and the response of roots and the rhizosphere to varying environmental conditions. This encompasses interactions among microbes, mycorrhizae, microfauna, fungi, soil heterogeneity, biogeochemical cycles, biotic and abiotic stresses, and emerging contaminants.

Knowledge prerequisites: This is an advanced course which examines the interactions between the plant root system and the environment. To be successful, students should have a general knowledge of biology, botany, microbiology, and soil chemistry.

LEARNING OBJECTIVES

After successfully completing this course, students will be able to:

- Recognize key anatomical and morphological features of plant roots.
- Describe the main physiological and biochemical responses in the root system.
- Identify the role of plant roots in the global context of soil development and atmosphere composition.
- Classify and recognize root-derived products.
- Compare different root system architectures.
- Describe root responses to biotic and abiotic stresses.
- Explain key root-rhizosphere interactions, from beneficial microorganisms to detrimental nematodes.
- Recommend modern research techniques for field and lab studies on plant roots.
- Locate, appraise, and assimilate evidence from recent scientific studies related to plant root science.

COURSE MATERIALS

Recommended textbooks

- Eshel, A.; Beeckman, T. (2013): **Plant Roots: The Hidden Half**, Fourth Edition. CRC Press. ISBN 978-14-398-4648-3.
- Dessaux, Y.; Hinsinger, P.; Lemanceau, P. (2010): **Rhizosphere: Achievements and Challenges**. Springer. ISBN 978-94-007-3092-2
- Cardon, Z.; Whitbeck, J. (2007): **The Rhizosphere: An Ecological Perspective**. Academic Press (Elsevier). eBook ISBN: 978-00-804-9304-6, Hardcover ISBN: 978-01-208-8775-0
- Pinton, R.; Varanini, Z.; Nannipieri, P. (2007): **The Rhizosphere: Biochemistry and Organic Substances at the Soil-Plant Interface**, Second Edition. CRC Press. ISBN 978-08-493-3855-7

EVALUATION OF LEARNING

Assignment		% of grade	Points
1)	15 Quizzes due every week	20	600
2)	6 Discussions due every other week	20	600
3)	Group project	25	750
4)	First Exam	10	300
5)	Mid-Term Exam	10	300
6)	Final Exam	15	450
	Total	**100**	**3000**

Quizzes

At the end of each module, a specific quiz will assess the student's learning. Ten questions related to each module will be available. Students will have 2 possible attempts. Points will be available for each question, for a total of 40 points per quiz.

Group project

Students will be assigned to a team, and each team will work on creating an Extension publication (*e.g.*, EDIS or a trade journal magazine paper) during the course. A list of suggested publication topics will be provided. All projects require approval from the instructor and the TAs. The project components consist of a short-written outline (due 9/18/2024), a mid-term project publication draft with a proposed bibliography (due 10/23/2024), and a final publication with pictures and graphics (due 12/4/2024). Each component contributes significantly to the final grade, and the overall project grade will be based on the quality of each component. Submit the project components to the instructor and the TAs via Canvas. Part 1 and 2 of the group project are each worth 200 points, while Part 3 is worth 350 points.

Criteria	Ratings			Points
Part One - Outline	200 to >100 points Outline is well defined and contains all the necessary information	100 to >0 points Outline only has some information but lacks clarity and organization	0 points Outline not submitted; or all expectations of group project part one not met	**200 points**
Part Two – Draft and Bibliography	200 to >100 points Draft is well written, and citations and references are appropriately chosen	100 to >0 points Draft is hard to read, lacks clarity and contains several errors and/or bibliography is poorly chosen or not submitted	0 points Draft and bibliography not submitted; or all expectations of group project part two not met	**200 points**
Part Three – Final Publication	350 to >175 points Publication reads well, is comprehensive and easy to understand; includes relevant graphics, figures and examples.	175 to >0 points Publication reads poorly, is not comprehensive and difficult to understand; and/or does not include relevant graphics, figures and examples.	0 points Publication not submitted; or all expectations of group project part three not met	**350 points**
				Total Points: 750

Discussions

At the end of every other week, a discussion board with a specific prompt will be ready for the students. Students will not be able to read posts made by other students until after they have already completed and submitted their own post. Each submitted post should consist of 500 words or less and must address all parts of the prompt. Each student will also be expected to post a reply to at least two other students' posts to receive credit. Poor quality submissions will receive partial credit. The grading procedures of the discussion will follow this rubric:

Criteria	Ratings			Points
Original Response to Prompt	60 to >30 points Responses addresses all parts of the prompt in a convincing and clear manner, and consist of 500 words or less	30 to >0 points Response only addresses some parts of the prompt and/or is significantly more than 500 words	0 points Response not submitted; or all expectations of discussion thread not met	**60 points**
Reply to Peers	40 to >20 points Student responds to at least 2 peers with substantive comments that further the conversation	20 to >0 points Student responds to only 1 peer with substantive comments or responds with 2 comments that lack significance	0 points Response not submitted; or all expectations of discussion thread not met	**40 points**
				Total Points: 100

Exams

There will be three exams in this course, each consisting of five questions. Exam 1 (covering Modules 1-5) and Exam 2 (covering Modules 6-10) will have 60 points available for each question. **The final exam will be conducted in person** and can be taken with a proctor at your department or research center. Throughout the semester, the main instructor and TAs will coordinate with students to organize the final exam. The first five questions of the final exam will be related to Module 11-15, with 60 points available for these questions. Additionally, there will be two comprehensive questions, each worth a total of 75 points. The final exam will be on a fixed date, and once started, students will have three hours to complete it.

Exams   **Content Covered**

1) First Exam   Modules 1-5

2) Mid-Term Exam   Modules 6-10

3) Final Exam   Modules 11-15, plus 2 comprehensive questions

Assignment Breakdown

	Points × Number of Assignments = Total Points
15 Quizzes	40 × 15 = 600
6 Discussions (6 prompts, 12 replies)	100 × 6 = 600
Group project part 1 and 2	200 × 2 = 400
Group project final part	350
2 Exams	300 × 2 = 600
1 Final Exam	450
Total	3000

Critical dates

Group Project Part 1	9/18/2024	(Outline)
First Exam (due online)	9/30/2024	(Modules 1-5)
Group Project Part 2	10/23/2024	(Draft and Bibliography)
Second Exam (due online)	11/4/2024	(Modules 6-10)
Group Project Part 3	12/4/2024	(Final Publication)
Final Exam (in-person)	12/9/2024	(Modules 11-15, plus comprehensive)

GRADING SCALE

A	=	94 - 100 %	C	=	‹ 77 - 74 %
A-	=	‹ 94 - 90 %	C-	=	‹ 74 - 70 %
B+	=	‹ 90 - 87 %	D+	=	‹ 70 - 67 %
B	=	‹ 87 - 84 %	D	=	‹ 67 - 64 %
B-	=	‹ 84 - 80 %	D-	=	‹ 64 - 61 %
C+	=	‹ 80 - 77 %	E	=	‹ 61 %

Additional information on current UF grading policies for assigning grade points can be found here:
- *Grading policy,* https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/#gradingpoliciestext

Course organization

The module material of a given week will be made available the Saturday of the week before. Assignments will be due on the Friday of a given module week.
Module 0: Introduction to the course
Module 1: Definition of the rhizosphere and origin of roots
Module 2: Root structure, functions, and modifications
Module 3: Regulation of root growth
Module 4: Classification and function of root derived products
Module 5: Root exudates and mineral nutrition
Module 6: Root system architecture and nutrient acquisition
Module 7: Legume-Rhizobia symbiosis
Module 8: Mycorrhizal fungi and nutrient acquisition
Module 9: Plant growth promoting rhizobacteria
Module 10: Drought and salt stress
Module 11: Heat and flooding stress
Module 12: Trace metals and emerging contaminants stress
Module 13: Stresses caused by pathogens
Module 14: Modern research techniques for field experiments
Module 15: Modern research techniques for laboratory experiments

<u>Course schedule</u>

8/22/2024	Introduction to the course. Module #1 and #2 opens
8/30/2024	Module #1 and #2 quiz due
8/31/2024	Module #3 opens
9/2/2024	**Labor Day**
9/6/2024	Module #3 quiz due – Discussion #1 due
9/7/2024	Module #4 opens
9/13/2024	Module #4 quiz due
9/14/2024	Module #5 opens
9/18/2024	**Group project part 1 due (outline)**
9/20/2024	Module #5 quiz due – Discussion #2 due
9/21/2024	Module #6 opens
9/23/2024	**First Exam (module 1-5) opens**
9/27/2024	Module #6 quiz due
9/28/2024	Module #7 opens
9/30/2024	**First Exam due (Modules 1-5)**
10/4/2024	Module #7 quiz due – Discussion #3 due
10/5/2024	Module #8 opens
10/11/2024	Module #8 quiz due
10/12/2024	Module #9 opens
10/18/2023	**Homecoming 🐊 Go Gators! 🐊**
10/19/2024	Module #10 opens
10/21/2024	Module #9 quiz due – Discussion #4 due
10/23/2024	**Group project part 2 due (draft and bibliography)**
10/25/2024	Module #10 quiz due
10/26/2024	Module #11 opens
10/28/2024	**Second Exam (Module 6-10) opens**
11/1/2024	Module #11 quiz due – Discussion #5 due

11/2/2024	Module #12 opens
11/4/2024	**Second Exam due (Modules 6-10)**
11/8/2024	Module #12 quiz due
11/9/2024	Module #13 opens
11/11/2024	**Veterans Day**
11/15/2024	Module #13 quiz due – Discussion #6 due
11/16/2024	Module #14 opens
11/22/2024	Module #14 quiz due
11/23/2024	Module #15 opens
11/25/2023	**Thanksgiving break**
11/29/2022	🦃 **Happy Thanksgiving!** 🦃
12/2/2024	Module #15 quiz due
12/4/2024	**Group project part 3 due (final publication)**
12/9/2024	**Final Exam (Modules 11-15, plus comprehensive)**

COURSE POLICIES

Attendance and Make-up Policy

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at:

- *UF Attendance policy,* https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "**We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity**." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (*e.g.*, assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action.

- For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code

In-Class Recordings

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are: (1) for personal educational use (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited.

Specifically, students may not publish recorded lectures without the written consent of the instructor. A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without the permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third-party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Policy on Course Syllabi Honor Code and Student Conduct Code.

- For more information regarding the Student Honor Code, please see: http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken when appropriate.

Canvas Technology Requirements

Computers, Internet, and Web browsers: Canvas runs on Windows, Mac, Linux, iOS, Android, or any other device with a modern web browser. It is recommended to use a computer less than five years old with at least 1GB of RAM. It is recommended to have a minimum Internet speed of 512kbps. It is strongly recommended to not use a wireless connection, phone, tablet, or notepad for critical course tasks such as exams and discussions.

Canvas currently supports the following browsers: Chrome, Safari, Firefox, Edge. Canvas supports the last two versions of most browsers. It is highly recommend updating to the newest version of whatever

browser you are using. Note that your computer's operating system may affect browser function. Failure to use one of these browsers will cause problems.

For more information on approved computers and browsers please visit: https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-are-the-browser-and-computer-requirements-for-Instructure/ta-p/66

On this web page there is an area titled "Is My Browser up to Date?" Use it to check each computer and browser you may use in this course. There is another important area on "Browser Privacy Settings." Read the section(s) for any browser intended for use. Note that: in browsers such as Safari, insecure content will never be displayed in the browser. Return to the page to check for updates on technology issues in Canvas.

If you encounter technical difficulties in this course, contact the UF Computing Help Desk right away to troubleshoot. https://helpdesk.ufl.edu/ or (352) 392-HELP. If the problem cannot be fixed immediately, notify your instructor, and provide them with the Help Desk ticket number.

Services for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

- *Disability Resource Center*, 0001 Reid Hall, (352) 392-8565, https://disability.ufl.edu/

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

· *Counseling and Wellness Center*, 3190 Radio Road, 392-1575**,** www.counseling.ufl.edu

> Counseling Services

> Groups and Workshops

> Outreach and Consultation

> Self-Help Library

> Wellness Coaching

· *U Matter We Care*, www.umatter.ufl.edu
· *Sexual Assault Recovery Services (SARS),* Student Health Care Center, 392-1161.
· *University Police Department,* 392-1111 (or 9-1-1 for emergencies), www.police.ufl.edu

Additionally, if you would like orientation on choosing a major, finding an internship, or planning your career, I encourage you to use the university's on-campus resources.

· *Career Connections Center,* CR-100 Reitz Union, 392-1601, https://career.ufl.edu/

Course Evaluation Process

Student assessment of instruction is an important part of the effort to improve teaching and learning. At the end of the semester, you are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at:

· *Course evaluations,* https://gatorevals.aa.ufl.edu/

Evaluations are typically open during the last two or three weeks of the semester. You will be notified of the specific times when evaluations for this course are open. Summary results of these assessments are available to students at:

· *Evaluations summary,* https://gatorevals.aa.ufl.edu/

Student Complaints

You can file and resolve any complaints about your experience in this course in the following site:

· *Student complaints in residential courses,* https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/
· *Student complaints in online courses,* http://distance.ufl.edu/student-complaint-process/