Advanced Horticultural Crop Physiology

HRT 401 (3 cr.)
Michigan State University
Spring 2026
Tu and Th 10:20-11:40 am; A159 Plant and Soil Sciences

INSTRUCTOR

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I check email frequently, so this is probably the best way to contact me if you have a quick question that does not require substantial discussion or if you want to schedule a time to meet in person or over Zoom.

Course Information

Goals

This course is designed to help you understand principles of light and temperature, and physiological and flowering responses of horticultural crop plants to light, temperature, nutrients, and gases. Students will use this information to understand how these factors are managed to improve production of horticultural crops. Another goal of this course is to improve communication skills of participants through inside and outside of classroom writing assignments and classroom participation.

Books and Materials

There is no required textbook for this course; however, there will be required readings throughout the semester. Required readings will either be available on the class *D2L* website or will be handed out in class. Several of the topics covered in this course require some computation, so please have a calculator with you at each class period (scientific notation calculator app will be sufficient).

Course Structure

This course will be delivered in-person but will utilize the *D2L* course management system and you will need your MSU NetID to login to the course from the *D2L homepage* (*http://d2l.msu.edu*). In *D2L*, you will access course materials (lecture slides, handouts, and reading materials), and access and submit assignments.

Policies, Procedures and Resources

Academic Integrity

Students are expected to do their own work. If it is determined that a student has engaged in any form of academic dishonesty, they may be given a grade of 0.0 for the course and may face

additional sanctions from the university. It's not worth it, so don't do it. More information on Michigan State University's academic honesty policies can be found at: https://ombud.msu.edu/resources-self-help/academic-integrity

Resource Center for Persons with Disabilities (RCPD)

- To make an appointment with a specialist, contact: (517) 353-9642
  Or TTY: (517) 355-1293
- Web site for RCPD: http://MYProfile.rcpd.msu.edu

Attendance Policy

Due to interactive activities in the course, attendance at each class session is required.

Make-up Exam and Late Assignments Policy

Make-up exams will only be offered to those who obtain permission from me in advance, and who have a legitimate excuse. If you are unsure whether or not your situation qualifies, come see me immediately. I will generally require independent verification for emergencies that arise after the class meeting prior to the exam.

For assignments not turned in on time, 10 percentage points will be subtracted from the original grade for each day that the assignment is late. For example, for a problem set worth 25 points, 2.5 points will be deducted for each day that the assignment is late.

Assignments, Assessment and Grading

Attendance

Attendance will be taken in each class session. Each student may have two unexcused absences without penalty. Each additional unexcused absence will result in a 5-point deduction (out of 50 possible attendance points).

Weekly summary write-ups

Ten times during the semester, you will be assigned to write a 2-page (typed and double-spaced) summary of the main topics covered in class during that week. These summaries will allow me to see if course concepts are coming through and should provide you with a resource to aid in studying for exams. Points will be awarded based on content (were all the necessary topics covered?), clarity of writing, and grammar.

Problem/Question sets

Three problem/question sets will allow students to review the concepts discussed in class and answer questions related to these concepts and the application of these concepts for commercial plant production. Some material in this course will require use of mathematics for problem solving.

Exams

There will be three exams during the semester. The final exam will take place during the university-scheduled final exam period. However, the final exam will not be cumulative, but will focus on material covered during the final third of the semester.

Manuscript critique paper

Each student will write a 3–4-page paper reviewing/critiquing one research manuscript, using a set of critique questions as your guide. The manuscript will be a scientific article in a topic area of the student's choosing that highlights recent findings related to the topics covered in class. Additional details will be posted on D2L and discussed in class.

Grading Criteria

Attendance	50 points
Manuscript review/critique	75
Problem/question sets (3 assignments; 25 point each)	75
Weekly summary writes (10 total; 5 points each)	50
Exam 1	100
Exam 2	100
Final Exam	100
Total	**550 points**

Grade Scale:

Total points	%	Grade point
495+	≥90	4.0
468-494	85-89	3.5
440-467	80-84	3.0
413-439	75-79	2.5
385-412	70-74	2.0
358-384	65-69	1.5
330-357	60-64	1.0
<330	<60	0.0

Tentative Schedule

Class Week	Topic	Notes
1 Jan. 13 & 15	Introduction; Radiation principles	Weekly summary write #1 due Jan. 18 at midnight.
2 Jan. 20 & 22	Light • Light quality and responses to light quality • Light duration and quantity	Weekly summary write #2 due Jan. 25 at midnight.
3 Jan. 27 & 29	Light • Plant responses: photosynthesis	Weekly summary write #3 due Feb. 1 at midnight.
4 Feb. 3 & 5	Light • Managing the light environment Temperature • Basic principles	Problem set 1 due Feb. 3; Weekly summary write #4 due Feb. 8 at midnight.
5 Feb. 10 & 12	Temperature • Principles • Plant responses: development and thermomorphogenesis	Exam 1 – Feb. 12
6 Feb. 17 & 19	Temperature: • Plant responses: stress	Weekly summary write #5 due Feb. 22 at midnight.
7 Feb. 24 & 26	Temperature: • Plant responses: stress Plant energy budgets • Modes of energy transfer	
	Spring Break March 2-6	
8 Mar. 10 & 12	Plant energy budgets	Weekly summary write #6 due Mar. 15 at midnight.
9 Mar. 17 & 19	Plant energy budgets • Energy balance and plant temp. Carbon Dioxide: • Plant responses	Problem set 2 due March 19; Weekly summary write #7 due Mar. 22 at midnight.
10 Mar. 24 & 26	Carbon dioxide • Depletion and enrichment	Exam 2 – March 26
11 Mar. 31 & Apr. 2	Ethylene and other pollutants; water vapor	Weekly summary write #8 due Apr. 5 at midnight.
12 Apr. 7 & 9	pH and nutrition • Factors impacting pH	Weekly summary write #9 due Apr. 12 at midnight.
13 Apr. 14 & 16	pH and nutrition • Nutrient availability and balance • Salinity stress	Weekly summary write #10 due Apr. 19 at midnight.
14 April 21 & 23	Flowering • Principles and phase change • Photoperiodism • Vernalization	Problem set 3 due April 21
Final Exam	Friday, May 1 at **7:45 am**, A159 PSSB	

HRT 401 Reading list Spring 2026 (additional readings may be added)

We will be utilizing academic journal articles as well as chapters from the following books:

Anderson, N.O. (ed.). 2007. Flower breeding and genetics: issues, challenges and opportunities for the 21st century. Springer

Fitter, A.H. and R.K.M. Hay. 2002. Environmental physiology of plants. 3rd ed. Academic Press, San Diego

Jones, H.G. 2014. Plants and microclimate: a quantitative approach to environmental plant physiology. 3rd ed. Cambridge University Press, Cambridge

H. Lambers, R. S. Oliveira, Plant Physiological Ecology 3rd. ed. Springer Nature Swiztzerland, Cham. https://doi.org/10.1007/978-3-030-29639-1_9

Nobel, P.S. 2020. Physicochemical and environmental plant physiology. 5th ed. Elsevier, Amsterdam

Thomas, B. and D. Vince-Prue. 1997. Photoperiodism in plants. Academic Press, San Diego

Class Week	Topic	Readings
1 Jan. 13 & 15	Introduction; Radiation principles	Jones: ch. 2 Radiation (p. 9-31)
2 Jan. 20 & 22	Light • Light quality and responses to light quality • Light duration and quantity	Fitter and Hay: ch. 2 (p.23-57)
3 Jan. 27 & 29	Light • Plant responses: photosynthesis	Lambers and Oliveira: ch. 2 (p. 11-16; 28-40)
4 Feb. 3 & 5	Light • Managing the light environment Temperature • Basic principles	Jones: ch. 9 (p.231-254)
5 Feb. 10 & 12	Temperature • Principles • Plant responses: development and thermomorphogenesis	
6 Feb. 17 & 19	Temperature: • Plant responses: stress	Lambers and Oliveira: ch. 2 (p.66-71) Lambers and Oliveira: ch. 7 (p. 283-288)
7 Feb. 24 & 26	Temperature: • Plant responses: stress Plant energy budgets • Modes of energy transfer	Nobel: ch. 7
	Spring Break March 2-6	
8 Mar. 10 & 12	Plant energy budgets	Nobel: ch. 7
9 Mar. 17 & 19	Plant energy budgets • Energy balance and plant temp. Carbon Dioxide: • Plant responses	Lambers and Oliveira: ch. 2 (p. 16-28; 72-80)
10 Mar. 24 & 26	Carbon dioxide • Depletion and enrichment	

11	Mar. 31 & Apr. 2	Ethylene and other pollutants; water vapor	
12	Apr. 7 & 9	pH and nutrition • Factors impacting pH	
13	Apr. 14 & 16	pH and nutrition • Nutrient availability and balance • Salinity stress	Lambers and Oliveira: ch. 9 (p. 301-325; 349-355)
14	April 21 & 23	Flowering • Principles and phase change • Photoperiodism • Vernalization	Thomas and Vince-Prue: ch. 1 Anderson: ch. 1