

Course (PNH02003): PLANT PHYSIOLOGY

1. General information

- Term: 5
- Credits: **Total credits: 3 (Lecture: 2.0 – Project: 1.0) - Self-study: 9.0**
- Credit hours for teaching and learning activities:
 - Lectures: 2 sections per week (2 lecture hours, equivalent to 100 minutes per section). 8 weeks in total.
 - Project performing in greenhouse: 5 prac. hours (250 minutes for each)
 - Self study: 135 hours (50 minutes each)
- Department conducting the course:
 - Department: Plant Physiology
 - Faculty: Agronomy
- Kind of the course:

General <input type="checkbox"/>		Foundation <input checked="" type="checkbox"/>		Specialization 1 <input type="checkbox"/>		Specialization 2 <input type="checkbox"/>	
Compulsory <input type="checkbox"/>	Elective <input type="checkbox"/>	Compulsory <input checked="" type="checkbox"/>	Elective <input type="checkbox"/>	Compulsory <input type="checkbox"/>	Elective <input type="checkbox"/>	Compulsory <input type="checkbox"/>	Elective <input type="checkbox"/>

- Parallel course(s): NH02001 (Botany)
- Prerequisite course(s): None
- Course language: English Vietnamese

2. Course objectives and expected learning outcomes

*** Course objectives:**

- Knowledge: The course provides students with knowledge in physiological processes in the plant body; the adaptation and acclimation to environmental stresses; application of appropriate cultivation techniques for crop production.
- Skills: The course provides students with skills in determining physiological indices of plants.
- Attitude: The course provides students with attitudes in a high sense of responsibility in their work and study when given the opportunity.

*** Course expected learning outcomes**

Notation	Course expected learning outcomes After successfully completing this course, students are able to	Program learning outcome's performance criteria
Knowledge		
CELO1	Describe processes of water exchange, photosynthesis, respiration, translocation in phloem, mineral exchange and the growth and development of flower, vegetable, fruit and landscape trees.	2.2 (P); 3.4 (P)
CELO2	Explain adequately the basic factors affecting to physiological processes of flower, vegetable, fruit and landscape trees in specific circumstances.	2.2 (P); 3.4 (P)
Skills		
CELO3	Work effectively in teamwork for project under management of tutorship.	4.1 (I); 6.3 (I)

CELO4	Apply exactly knowledges of growth and development of flowers, vegetables, fruits and landscape trees to the planning, implementation, and maintenance of market-driven landscaping.	4.1 (I); 6.3 (I)
CELO5	Compare the advantages and disadvantages of the new methods/techniques and selecting the most appropriate methods/techniques for cultivation of flower, vegetable, fruit and landscape trees; achieving and maintaining landscaping that meets artistic, environmental and economic impacts.	4.1 (I); 6.3 (I)
Attitude		
CELO6	Be willing to learn new knowledge and techniques in managing growth and development of flower, vegetable, fruit and landscape trees to improve yield, quality, environmental protection and economic impacts.	10.2 (I)

3. Course description

Brief description of the course: This course provides students with knowledge in physiological processes in the plant body and skills in determining plant physiological indices. The course includes the following chapters: Plant cell physiology; Water exchange; Mineral element exchange; Plant photosynthesis; Plant respiration; Translocation in the phloem; Plant growth and development; Plant stress and acclimation.

4. Teaching and learning & assessment methods

Teaching methods	CELO1	CELO2	CELO3	CELO4	CELO5	CELO6
Lecture	x	x	x	x	x	
Discussion	x	x	x	x	x	
Pratice	x	x	x	x	x	x
Project	x	x	x	x	x	x

5. Student tasks

- Learning attitude: students must attend all lectures in class and practice.
- Prepare for lectures, self-study: students must read or prepare materials related to the lesson in class under the guidance of the teacher.
- Practice and work in groups: students complete practical exercises, project performing, write individual reports or in groups under the guidance of teachers.
- Essay and final exam: students must complete the essay and final exam according to the regulations of the university.

6. Textbooks and references

** Textbooks/Lecture Notes:*

1) Hoàng Minh Tấn, Nguyễn Quang Thạch, Vũ Quang Sáng (2006). Giáo trình sinh lý thực vật. NXBNN I Hà Nội;

2) Trần Anh Tuấn (editor in chief) (2020). Thực hành sinh lý thực vật. Tài liệu lưu hành nội bộ.

** Additional references:*

1. Nguyễn Như Khanh, Cao Phi Bằng, Trần Thị Thanh Huyền, Nguyễn Thị Ngọc Lan, Nguyễn Tấn Lê, Phan Văn Tân, Võ Minh Thứ, Lê Văn Trọng (2020). Sinh lý học dinh dưỡng ở thực vật. NXB Giáo Dục, Việt Nam.
2. Lincoln Taiz, Eduardo Zeiger, Ian Max Møller, Angus Murphy (2018). Fundamentals of Plant Physiology (1st Edition). Sinauer Associates is an imprint of Oxford University Press.
3. Lincolh Taiz, Eduardo Zeiger, Ian Max Møller, Angus Murphy (2014). Plant physiology and Development (6th Ed). Sinauer Associates is an imprint of Oxford University Press.
4. Vũ Quang Sáng, Nguyễn Thị Nhẫn, Mai Thị Tân, Nguyễn Thị Kim Thanh, Phạm Văn Cường, Nguyễn Văn Phú (2014). Sinh lý thực vật ứng dụng. NXBNN Hà Nội.
5. Vũ Văn Vụ, Vũ Thanh Tâm, Hoàng Minh Tấn (2007). Sinh lý học thực vật. NXB Giáo Dục, Hà Nội.

6. Course outline

Week	Content	Course expected learning outcomes
1	Chapter 1: Plant cell physiology	
	A) Main contents: (2.0 hours) Theory: (2.0 hours) 1.1. Structure, basic functions of organelles in plant cell 1.2. Functions of water, protein, lipid in plant cell 1.3. Physical properties of protoplasm 1.4. Coacervation property of of protoplasm 1.4. Water exchange of plant cell Discussion: (0 hours)	K1, K2, K5
	Project: (2.0 hours) 1. Advising of searching the involving documents 2. Advising of choosing equipments, material for project	K3, K4, K5
	B/ Self- study contents: (4.0 hours) 1. Physical properties of protoplasm and abiotic stresses tolerance 2. Mechanism of water uptake and the effects of enviromental factors 3. Mechanism of mineral element uptake and the effects of enviromental factors 4. Equation of water potential	K1, K2, K6
1, 2	Chapter 2: Water exchange A) Main contents: (3.0 hours) Theory: (2.0 hours) 2.1. Functions of water in plant body	K1, K2, K5

Commented [VDH1]:

	<p>2.2. Water uptake in root system and the effects of environmental factors</p> <p>2.3. Water transport and the effects of environmental factors</p> <p>2.4. Water transpiration and the effects of environmental factors</p> <p>2.5. Water balances and the scientific theory of irrigation</p> <p>Discussion: (1,0 hour)</p> <p>Choosing a subject of project and planning to carry out</p>	
	<p>Project contents: (3,0 hours)</p> <ol style="list-style-type: none"> 1. Checking the condition and availability of nethouse and equipments 2. Discussion to completeness of project draft 3. Making plan carrying out the project 	K3, K4, K5
	<p>B) Self- study contents: (6,0 hours)</p> <ol style="list-style-type: none"> 1. The factors affect to water uptake, water transport and transpiration in plant 2. Water balance and the method of determination 3. The appropriate methods of irrigation 4. Seminar preparation: water uptake, Translocation in phloem and transpiration; Physiological drought and the overcoming 	K1, K2, K6
3,4	<p>Chapter 3: Plant photosynthesis</p>	
	<p>A) Main contents: (5,0 hours):</p> <p>Theory: (4,0 hours):</p> <ol style="list-style-type: none"> 3.1. Concepts of photosynthesis 3.2. Photosynthesis apparatus and pigments 3.3. Photosynthesis in C₃, C₄, CAM plants 3.4. Assimilation of CO₂ in root 3.5. Light and photosynthesis 3.6. CO₂, water, temperature, mineral nutrition and photosynthesis 3.7. Biological yield; Economic yield; Harvest index and the methods of improvement <p>Discussion: (1,0 tiết)</p> <p>Choosing the cultivation system and present the chosen system; receiving the comments of adviser and other student groups for completeness of plan draft</p>	K1, K2, K5
	<p>Project contents: (5,0 tiết)</p> <ol style="list-style-type: none"> 1. Comment about the project draft 2. Evaluation and approval the project drafts 	K3, K4, K5
	<p>B) Self- study contents: (10,0 hours)</p> <ol style="list-style-type: none"> 1. Temperature and photosynthesis 2. CO₂ concentration of the air, water, mineral nutrition and photosynthesis 	K1, K2, K6

Commented [VDH2]:

	3. Photosynthesis and yield and the methods of yield improvement 4. Seminar preparation: Project draft and the carrying out plan	
4,5	Chapter 4: Plant respiration	
	A) Main contents: (5,0 hours) Theory: (4,0 hours): 4.1. Concepts of respiration 4.2. Structure and function of mitochondria. Roles of respiration in plant 4.3. Essence of cellular respiration and the energy use efficiency 4.4. Effects of temperature, water content, CO ₂ and O ₂ concentration and mineral nutrition to respiration 4.5. Respiration rate; respiration quotient 4.6. Relationship of respiration and photosynthesis and the their contribution to yield 4.7. Respiration and the preservation of agricultural products Discussion: (1,0 hour) Dissolving of appeared problems in carrying out of approved projects	K1, K2, K5
	Project contents: (1,0 hour) Excution of approved projects	K3, K4, K5
	B) Self- study contents: (10,0 hours) 1. Essence of cellular respiration in plant 2. The evaluation of respiration ability 3. Roles of respiration in plant 4. Seminar preparation: Dissolving of appeared problems in carrying out of approved projects	K1, K2, K6
6,7	Chapter 5: Translocation in phloem	
	A) Main contents: (2,0 hours) Theory: (1,0 hour) 5.1. The ways for transport in plant body 5.2. Sink and source of transport in plant body 5.3. Effects of environment on translocation in plant body Discussion: (1,0 hour) The factors affect to growth and development of plants in cultivation systems (performing project)	K1, K2, K5
	Project contents: (1,0 hour) Inspecting, evaluating of performing progress of projects	
	B) Self- study contents: (4,0 hours) Seminar preparation: The factors affect to growth and development of plants in cultivation systems (performing project)	K1, K2, K6

Commented [VDH3]:

	Chapter 6: Plant nutrition	
7, 8	<p>A) Main contents: (5,0 hours) Theory: (4,0 hours) 6.1. Essential elements and the classification 6.2. Effects of environment (temperature, pH, O₂, water and light regime) on mineral uptake of root 6.3. Funtion of phosphate 6.4. Funtion of potassium 6.5. Funtion of calcium 6.6. Funtion of magesium 6.7. Funtion of sulphate 6.8. Funtion of micro elements and using of micronutrients 6.9. Funtion of nitrogen. Assimilation of NH₄⁺ và NO₃⁻ 6.10. Fixation of nitrogen gas (N₂ fixation) 6.11. Nutrion uptake without root 6.12. Optimization of fertilizing Discussion: (0,0 hour)</p> <p>Project contents: (3 hours) Harvesting, checking and taking over the projects</p>	K1, K2, K5
	<p>B) Self- study contents: (10,0 hours) 1. Functions of the macroelements 2. Functions of the microelements 3. Effects of environment (temperature, pH, O₂, water and light regime) on mineral uptake of root 5. Fertilizing technics of macronutrition and micronutrition 6. Diagnosis of nutrition situations in crops 7. Roles of nutrition in crop stress resistance 8. Preparing for project report</p>	K1, K2, K6
	Chapter 7: Plant growth and development	
9, 10	<p>A) Main contents: (5,0 hours) Theory: (4,0 hours): 7.1. Basic concepts of plant growth and development 7.2. Roles of auxin, gibberellin, cytokinin and their application in agriculture 7.3. Roles of ethylen, ABA, retardants and their application in agriculture 7.4. Phytohormone balances 7.5. Fundamentals of plant regulator using.</p>	K1, K2, K5

	<p>7.6. Interrelationship between growth stages in plant and its application in agriculture</p> <p>7.7. Vernalization and its application in agriculture</p> <p>7.8. Photoperiodism and its application in agriculture</p> <p>7.9. Physiology of fruit set, seedless fruit and its application in agriculture</p> <p>7.10. Physiology, biochemistry of ripening. The control of fruit ripening</p> <p>7.11. Physiology of abscission and the management</p> <p>7.12. Physiology of dormancy and the management</p> <p>Discussion: (0,0 hour)</p>	
	Project contents: (0 hour)	
	<p>B) Self- study contents: (10,0 hours)</p> <p>1. Phytohormone balances and their application</p> <p>2. Fundamentals of plant regulator using</p> <p>3. Hypothesis of flowering and control of flowering</p> <p>4. Preparing for project report</p>	K1, K2, K6
10	Chapter 8: Physiology of plant stress tolerance	
	<p>A) Main contents: (3,0 hours)</p> <p>Theory: (1,0 hours)</p> <p>8.1. Concepts of plant stress tolerance</p> <p>8.2. Mechanism of drought tolerance and its application</p> <p>8.3. Mechanism of heat tolerance and its application</p> <p>8.4. Mechanism of chilling tolerance and its application</p> <p>8.5. Mechanism of salinity tolerance and its application</p> <p>8.6. Mechanism of submergence tolerance and its application</p> <p>8.7. Mechanism of lodging resistance and its application</p> <p>Discussion: (2,0 hours)</p> <p>Presentation of project report</p>	K1, K2, K5
	Project contents: (0 hour)	
	<p>B) Self- study contents: (6,0 hours)</p> <p>1. Physiology of stress tolerances in plant and their application in crop production</p> <p>2. Preparing for project report</p>	K1, K2, K6