

## RQ02029: IRRIGATION AND DRAINAGE MANAGEMENT

### 1. General information

- Term: 5
- Credits: **Total credits 02 (Lecture: 1,5 – Practice: 0,5)**
- **Self-study: 90** credits
- Credit hours for teaching and learning activities: 30 hrs
- Department conducting the course:
  - Department: Resource Management
  - Faculty: Natural Resources and Environment
- Kind of the course:

Foundation <input type="checkbox"/>		Fundamental <input type="checkbox"/>		Option 1 <input type="checkbox"/>		Option 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"/>

- Prerequisite course(s): No

### 2. Course objectives and expected learning outcomes

**\* Course objectives:**

- Knowledge: Course provided for students with basic knowledge of plant – water – soil relationship, the principle of surface water adjustment, and the technique of irrigation methods.
- Skills: The Course provides students with skills in irrigation regime calculation, planning for design and arranging space for irrigation systems in the field, installing irrigation equipment to operate the irrigation methods and approach when studying the relevant subjects.
- Attitude: The Course provides students with attitudes in self-motivated, active, honest and responsible scientific research as well as in professional activities, socially responsible and disciplined.

**\* Course expected learning outcomes**

Notation	Course expected learning outcomes	PLO performance criteria
	After successfully completing this course, students are able to	
<b>Knowledge</b>		
CELO 1	Applying environmental science knowledge to the Horticulture and Landscape design program - Evaluation criteria K1: + Properly analyze the relationship and interaction between water and environmental factors in the production of a fruit and vegetable to meet market demand. - Evaluation method: final exam	1.2
CELO 2	Application of crop farming techniques to build high-tech models of fruit and vegetable production to meet market demand - Evaluation criteria K2:	2.2

	+ Properly calculate the water demand and irrigation regime of the crops to serve the production of fruit and vegetable products to meet the market demand. - Assessment method: Final exam	
CELO 3	Apply knowledge of landscape design to the maintenance of the landscape according to artistic and technical standards - Evaluation Criteria K3: Presenting irrigation techniques suitable for plants for landscape design - Evaluation method: Essay	3.4
<b>Skills</b>		
CELO 4	Practical survey to discover problems that need to be researched - Evaluation Criteria K4: Proficiently and accurately performing techniques to determine soil moisture, water needs of plants, irrigation techniques in specific practical conditions - Assessment method K3: Practice (2 lessons of chapter 2 and 1 lesson of chapter 5)	6.1
<b>Attitude</b>		
CELO 5	Show serious work spirit and high responsibility while performing professional work. - Evaluation criteria K5: Actively participate in class presentations Properly implementing the actual survey plan, ensuring the time, quality and efficiency of the work. - Evaluation method K5: Diligence, practice	10.2

### 3. Course description

Brief description of the course: This course consists of 6 chapters about Water and water use; Water in the soil; Evapotranspiration; Irrigation Scheduling; Irrigation methods; Irrigation system and practices of 03 parts: Determine soil moisture; Determine infiltration; practice about Sprinkler and Drip irrigation

### 4. Teaching and learning & assessment methods

CELOs	CEL O1	CELO 2	CELO3	CELO4	CELO5
<b>Teaching and learning</b>					
Lecturing	x	x	x		x
Practical work				x	x
Essay			x		
<b>Assessment</b>					
Rubric 1. Attendance (10%)					x
Rubric 2. Practical (15%)				x	x
Rubric 3. Essay (15 %)			x		
Rubric 4. Final exam (60%)	x	x			

## 5. Student tasks

- Attendance: All students taking this course must by According to the regulations of the VNUA
- Preparation for the lecture: All students taking this course must read the relevant book chapter and handout before the class
- Practice: All students taking this course must 5 number of experiments, individual/groups of 3-5 students
- Essay: The students must complete the essay by the teacher's deadline
- Final exam: All students must have One Final exam by According to the regulations of the VNUA

## 6. Textbooks and references

### \* *Text Books/Lecture Notes:*

1. Ngo Van Quan and cs (2020). Water Resources Engineering. Bach Khoa Publishing House
2. Pham Viet Hoa, Nguyen Luong Bang (2020). Design of irrigation and drainage systems. Bach Khoa Publishing House
3. Nguyen Van Dung; Ngo Thi Dung; Nguyen Thi Giang; Vu Thi Xuan (2016); Irrigation and Drainage. The Agricultural Academy Publishing House.
4. Ngo Thi Dung và cs (2021). Water management. The Agricultural Academy Publishing House.

### \* *Additional references:*

1. Samiha Ouda, Abd El-Hafeez Zohry and Tahany Noreldin (2020). Deficit Irrigation. Springer Nature Switzerland AG 2020.
2. Southern institute of water resources research (2017), Collection of results of science and technology 2016. No. 19, ISSN 0866 – 7292.
3. Nguyen Thi Giang, Ngo Thi Dung (2020). Effect of drip irrigation and pressing granular fertilizer On the tomato yield and water use efficiency On red river fluvisols. Journal VietNam soil science N<sup>o</sup> 60/2020

## 7. Course outline

<b>Week</b>	<b>Content</b>	<b>Course expected learning outcomes</b>
1	<i>Chapter 1: Agricultural production and water use</i>	

	<p><b>A/ Main contents:</b> (02 periods)  <b>Theories:</b> (02 hours)</p> <p>1.1. The role of water  1.2. History of agricultural production  1.2.1. Rain-fed agricultural production  1.2.2. Irrigated agricultural production  1.2.3. Rain - fed area with model  1.2.4. Water Resources related issues  <b>1.3. Desertification and Drought</b>  1.3.1. Definition  1.3.2. Causes of desertification  1.3.3. Drought  1.3.4. Water Resources Development  1.4. Impact of nature on land use and water management  1.4.1. Land use  1.4.2. Forest  1.5. Natural features related to water use  1.5.1. Relevant weather and climate characteristics  1.5.2. Land characteristics related to horticulture</p>	CELO1
	<p><b>B/ Self-study contents:</b> (06 hours)</p> <p>1.6. Read the material and book chapter, handout related to water resources and agricultural production before the class  1.7. Desertification and Drought; Water Resources Development  1.8. Forest and the role of forests for soil protection</p>	
2-3	<p><b>Chapter 2: Water in the soil</b></p> <p><b>A/ Main contents:</b> ( 08 hours)  <b>1. Theories:</b> (05 hours)  <b>Theory:</b></p> <p>2.1. Indicator in water use and water management  2.1.1. Definition  2.1.2. Indicator  2.2. Impact of water resources on surroundings  2.2.1. Impact of water resource on soil environment  2.2.2. Influence of water recourse to the microclimate conditions  2.2.3. Impact of water recourse on crop yield  2.3. Hydrological cycle  2.3.1. Definition  2.3.2. Water balance  2.3.3. Human Impact on Water Cycle  2.3.4. Human role in adjusting the components of the water cycle  2.4. Water in the soil  2.4.1. Soil structure  2.4.2. Type of water in soil  2.4.3. Soil-Water potential and soil moisture</p>	CELO1; CELO2 CELO4; CELO5

	<p>2.4.4. Calculating soil water content</p> <p>2.4.5. Soil moisture</p> <p>2.5. Soil moisture measuring</p> <p>2.5.1. Water balance models</p> <p>2.5.2. Methods and devices of measuring the water content</p> <p>2.6. Infiltration</p> <p>2.6.1. Introduction</p> <p>2.6.2. Equipments</p> <p>2.6.3. Infiltration in unsaturated soils</p> <p>2.6.4. Infiltration in paddy rice</p> <p>2.6.5. Methods of measuring infiltration</p> <p>2.6.6. Infiltration roles</p> <p><b>2. Practice: (03 hours)</b></p> <p>Practice 1: Soil moisture measuring</p> <p>Practice 2: Infiltration</p>	
	<p><b>B/ Self-study contents: (24 hours)</b></p> <p>2.7. Impact of water resources on surroundings</p> <p>2.8. Hydrological cycle</p> <p>2.9. Soil moisture measuring</p> <p>2.10. Infiltration</p> <p>2.11. Data analysis and reports</p>	
	<p><b>Chapter 3: Evapotranspiration</b></p>	
4	<p><b>A/ Main contents: (05 hours)</b></p> <p><b>Theory: (03 hours)</b></p> <p>3.1. Evapotranspiration</p> <p>3.1.1. Definition</p> <p>3.1.2. Why Estimate evapotranspiration</p> <p>3.2. Soil-plant-water relationship</p> <p>3.2.1. Evaporation and transpiration</p> <p>3.2.2. Determine evapotranspiration by experiment methods</p> <p>3.2.3. Determine evapotranspiration by climate indicators</p> <p>3.3. Evapotranspiration Modeling (Cropwat)</p> <p>3.3.1. Cropwat 8.0</p> <p>3.3.2. Cropwat for window</p>	CELO1; CELO2
	<p><b>B/ Self- study contents: (15 hours)</b></p> <p>3.4. Determine evapotraspiration by Cropwat</p> <p>- Data: ET and Eto</p> <p>- Practice the Cropwat model</p> <p>3.5. Data analysis and reports</p>	

	<b>Chapter 4: Irrigation regime for crops</b>	
5-6	<p><b>Main contents: (04 hours)</b></p> <p><b>Theory: (03 hours)</b></p> <p>4.1. Meaning and content</p> <p>    4.1.1. Concept</p> <p>    4.1.2. Meaning and content</p> <p>4.2. Irrigation scheduling</p> <p>    4.2.1. Factors affecting the time of irrigation</p> <p>    4.2.2. Methods of determining time of Irrigation</p> <p>4.3. Irrigation standards</p> <p>    4.3.1. Concept</p> <p>    4.3.2. Irrigation standards</p> <p>    4.3.3. Examples</p> <p>    4.3.4. Factors affecting the watering standards</p> <p>4.4. Frequency of irrigations</p> <p>    4.4.1. Concept</p> <p>    4.4.2. Factors affecting the frequency of irrigations</p> <p>4.5. Irrigation requirement</p> <p>    4.5.1. Concept</p> <p>    4.5.2. The effective rainfall</p> <p>    4.5.3. Irrigation requirement</p> <p>    4.5.4. Irrigation requirement for reclaimed land</p> <p>4.6. Coefficient of irrigation</p> <p>    4.6.1. Objectives of irrigation coefficient calculation</p> <p>    4.6.2. Calculation of irrigation coefficient</p> <p>4.7. Calculation of irrigation regime</p> <p>    4.7.1. Definitions</p> <p>    4.7.2. Calculation of water regime for spring rice</p>	CELO1; CELO2; CELO4
	<p><b>B/ Self- study contents: ( 12 hours)</b></p> <p>4.8. Collection of study documents</p> <p>    4.8.1. Determination of the time of irrigation; irrigation standards; irrigation requirement</p> <p>    4.8.2. Calculation of irrigation requirement for dry crop and rice</p> <p>    4.8.3. Preparation for the seminar on the related topics</p>	
7	<p><b>Chapter 5: Irrigation methods and Techniques</b></p> <p><b>A/ Main contents: (06 hours)</b></p> <p><b>Theory (03 hours):</b></p> <p>5.1. Overview of irrigation methods and irrigation techniques</p> <p>    5.1.1. Definition</p> <p>    5.1.2. Classed irrigation methods</p>	CELO1; CELO2; CELO3; CELO4; CELO5

	<p>5.1.3. Irrigation methods and their selection</p> <p>5.2. Irrigation status</p> <p>5.2.1. Irrigation status in the world</p> <p>5.2.2. Irrigation status in Vietnam</p> <p>5.3. Irrigation requirements of cropping systems</p> <p>5.3.1. General requirements</p> <p>5.3.2. Field size in rice - dry crop rotation</p> <p>5.4. Surface irrigation Technique</p> <p>5.4.1. Introduction</p> <p>5.4.2. Border irrigation</p> <p>5.4.3. Furrow irrigation</p> <p>5.4.4. Land leveling</p> <p>5.5. Sprinkler Irrigation technique</p> <p>5.5.1. Concept</p> <p>5.5.2. Advantages and disadvantages</p> <p>5.5.3. Components of a Sprinkler system</p> <p>5.5.4. Sprinkler irrigation technique</p> <p>5.5.5. Determination of technical indicators</p> <p>5.5.6. Determination of irrigation requirement</p> <p>5.6. Drip Irrigation technique</p> <p>5.6.1. Concept</p> <p>5.6.2. Advantages and disadvantages</p> <p>5.6.3. Equipment and working principle</p> <p>5.6.4. Drip emitter</p> <p>5.6.5. Drip irrigation technique</p> <p>5.6.6. Some equipments used in production</p> <p><b>Practice:</b> (03 hours)</p> <p>Laboratory session 3: sprinkler and drip irrigation technique</p>	
	<p><b>B/ Self- study contents:</b> (18 hours)</p> <p>5.7. Read the materials on irrigation methods</p> <p>5.8. Data processing and writing report on laboratory session (session 3)</p>	
	<p><b>Chapter 6:</b> Irrigation system</p>	
7-8	<p><b>A/ Main contents:</b> (03 hours)</p> <p><b>Theory:</b> (03 hours)</p> <p>6.1. Overview</p> <p>6.1.1. Role and function of an irrigation system</p> <p>6.1.2. Land use coefficient, land occupancy coefficient</p> <p>6.1.3. Components of an irrigation system</p> <p>6.2. Source of irrigation water</p> <p>6.2.1. Sources of irrigation water</p> <p>6.2.2. Principles of selecting irrigation water source</p> <p>6.2.3. Preliminary calculation of irrigation water</p> <p>6.3. Irrigation system</p>	<p>CELO1; CELO2; CELO3; CELO4</p>

	<ul style="list-style-type: none"> <li>6.3.1. Classification and notation</li> <li>6.3.2. General principles and forms of irrigation canal layout</li> <li>6.3.3. Specification of an irrigation system</li> <li>6.3.4. Wastewater and wastewater treatment for irrigation</li> <li>6.4. Drainage system <ul style="list-style-type: none"> <li>6.4.1. Function of a drainage system</li> <li>6.4.2. Components of a drainage system</li> <li>6.4.3. Principles of drainage system layout</li> </ul> </li> <li>6.5. Canal structures <ul style="list-style-type: none"> <li>6.5.1. Intakes</li> <li>6.5.2. Bridge aqueducts</li> <li>6.5.3. Backwards siphon</li> <li>6.5.4. Culvert</li> <li>6.5.5. Fall and drop structures</li> <li>6.5.6. Overflow bank</li> <li>6.5.7. Bridge</li> <li>6.5.8. Flow measurement works</li> </ul> </li> <li>6.6. On farm irrigation system <ul style="list-style-type: none"> <li>6.6.1. Structure, tasks and requirements of the system</li> <li>6.6.2. Irrigation system for dry field</li> <li>6.6.3. Irrigation system for paddy rice field</li> </ul> </li> <li>6.7. Planning for water use <ul style="list-style-type: none"> <li>6.7.1. Concept</li> <li>6.7.2. Water use planning document</li> <li>6.7.3. Planning for water use</li> <li>6.7.4. Meaning of water use planning</li> </ul> </li> </ul>	
	<p><b>B/ Self- study contents: (09 hours)</b></p> <ul style="list-style-type: none"> <li>6.8. Prepare an essay on irrigation scheduling</li> </ul>	