

Irrigation and Drainage Engineering

(Soil Water Regime Management)

(ENV-549, A.Y. 2025/26)

4ETCS, Master option

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Platform of Hydraulic Constructions

Wrap-up and Exam Questions

Oral Exam IDE 2024-2025

List of Exemplary questions

Lecture 1.1

- Worldwide water use and percentages
- Irrigation techniques and types (fundamental vs complement)
- Irrigation techniques and relative use

Lecture 1.2

- Explain the major forms of root tropism and their causes
- Explain different plant species' water needs (Xerophytes, Mesophytes, etc.)

Lecture 1.3

- Soil characteristics and moisture levels and definitions (AWC, TAW, RAW, etc.) using the scheme
- Water quality issues. Explain salinity and alkalinity and related indexes, show how to use the classification diagram (provided)

Lecture 2.1

- Constitutive vs transpiration water
- Water balance for irrigation needs (Crop water need) and computation of related terms
- Reference vs maximal evapotranspiration, link between ET_0 and ET_M (FAO method)?
- Crop factor, what is it and how to use it (sketch and explain)?
- Effective water needs for irrigation and related efficiency. Forecasting water need and return period

Lecture 2.2

- Effective water needs and irrigation efficiency
- Sketch a typical setup of gravity irrigation network (linear and punctual structures)
- Characteristic flow, handling flow, dose, frequency and duration
- Differences between distribution by rotation and on demand. Explain Clement's formula (not remember by heart)
- Energy lines for inversed siphons

Lecture 3.1

- Design of water canals. Main concepts, Manning-Strickler formula
- Longitudinal vs cross section profile design

Lecture 3.2

- Practical realisations of canals
- Longitudinal profile design: velocity best practice criteria
- Embankment technique for trapezoidal canals
- Earthen made canals
- Advantages and disadvantages of different types of canal lining and drainage. Describe

Lecture 4.1

- Practical realisations of canals
- Longitudinal profile design: velocity best practice criteria
- Embankment technique for trapezoidal canals
- Earthen made canals
- Advantages and disadvantages of different types of canal lining

Lecture 4.2

- Crossing infrastructures
- Infrastructures for water regulation: types and usage
- Upstream regulation (sketch types and explain adv vs dis)
- Downstream regulation (sketch types and explain adv vs dis)
- Weirs and diverter. Explain

Lecture 5.1

- AMIL gate, sketch and explain the functioning principle
- AVIO gate, sketch and explain the functioning principle
- Disc valves, sketch and explain the functioning principle
- Water regulation and partitioning structures: types and uses
- Rating curve of the mask module (single and multiple)

Lecture 5.2

- Distribution chambers, proportional distribution
- Safety Infrastructure: concept and use. Explain
- Syphon: hydraulic functioning and grade lines
- Water application methods and distribution
- Gutter, boards, basin irrigations
- Furrow irrigation
- Irrigation by submersion (and prolonged submersion)

Lecture 6.1*

- Pressurized irrigation: components and objectives
- List and sketch the components of a pressurized irrigation setup
- Water sprinklers. Types, selection, and displacement
- Practical calculation of friction losses in ramps

*Pipe hydraulics is considered to be known (e.g. Moody diagram)

Lecture 6.2

- Pumped systems: Hydraulic head schemes and functioning points
- Pumped systems: economic design of pumped pipeline
- Forces on anchoring systems. Explain
- Max overhead for rapid closures (water hammer)

Lecture 7.1

- Sprinkler systems and uniformity coefficient. Explain
- Practical organization of sprinkler systems
- Frost danger and related avoidance methods
- Criteria for frost fighting

Lecture 7.2

- Microirrigation. Explain concepts, adv vs disadvantages
- Dripping system classification, list and explain

- Sketch a typical microirrigation setup: components and related displacement
- Hydraulic design of drippers and desired characteristics

Lecture 8.1

- Pressure compensated drippers
- Mounting the drippers and moisture bulb
- Ramp Design, Darcy vs Hazen-Williams formulas

Lectures 8.2 and 9.1

- Irrigation impacts. List and describe possible negative impacts
- Salt water intrusion, derivation of the equilibrium condition (Ghiben-Herzberg model)
- Sanitary impacts: describe the main waterborne diseases, causes, effects on men and remedies (choose one and describe)

Lecture 9.2

- Water pound formation: causes and remedies through drainage
- List and explain the main drainage techniques methods (choose one to explain in detail)

Lecture 10.1

- Main hypotheses for the hydraulic draining space design
- Permissible submersion and characteristic draining rate: explain
- Explain the permanent vs the transitory regimes and the main working hypotheses

Lecture 10.2

- Calculation of drainage space gap in permanent regime and for pipes on an impermeable bed
- Calculation of drainage space gap in permanent regime and for channels on an impermeable bed
- Drains and pipes not lying on an impermeable layer. Houghoudt analogy method: explain

Lecture 11.1

- Draining trenches. Derivation of the flow equation
- Variable regime: derivation of the space gap for drains located on an impermeable bed.
- Drainage by wells: derivation of the pumping rate and superposition principle
- Types of draining networks

Lecture 11.2

- Draining pipes: materials and selecting criteria
- Type of clogging: primary vs secondary
- Causes of pipe filling: list and explain
- Filters for risk of filling and calculation (using the tables provided)

Lecture 12.1

Visit to the irrigation facility

Lecture 12.2

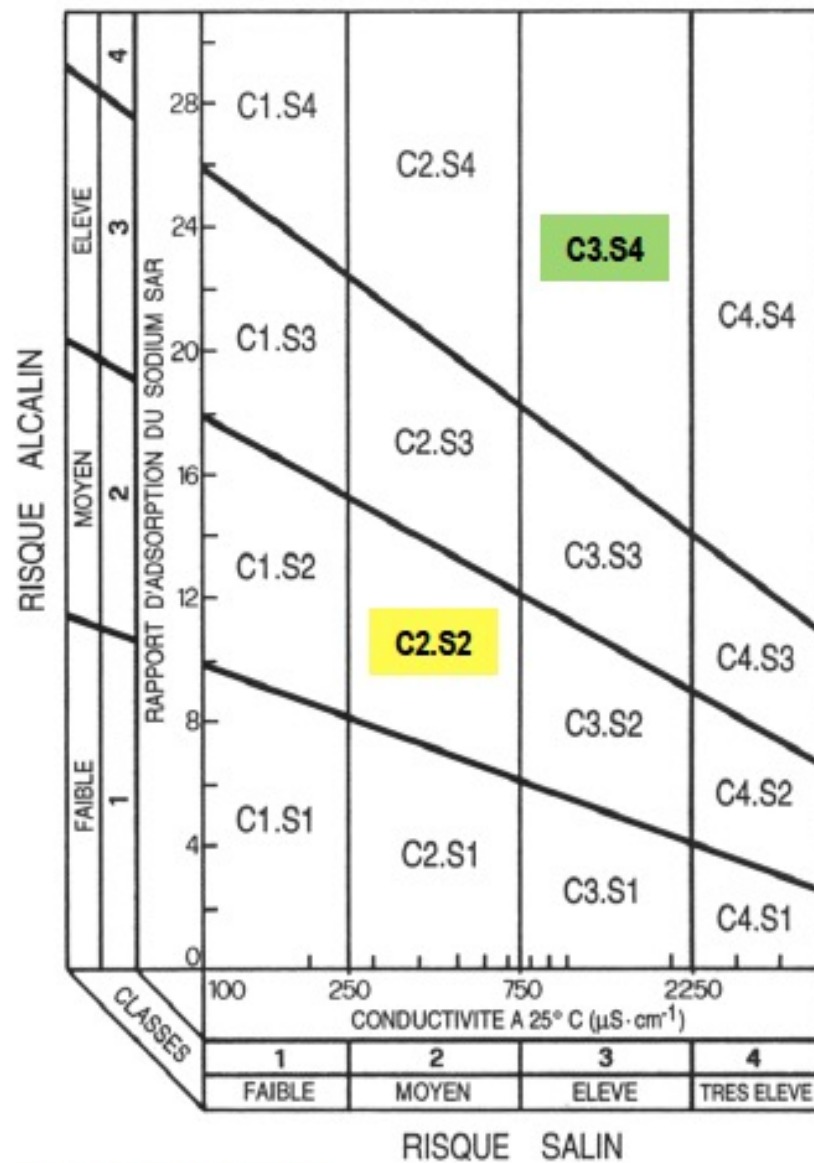
- Materials used for drainage conduits. Why old earthenware pipes are not being used anymore?

Lecture 13.1

- Drain execution techniques: list different machines and explain adv vs disadv.

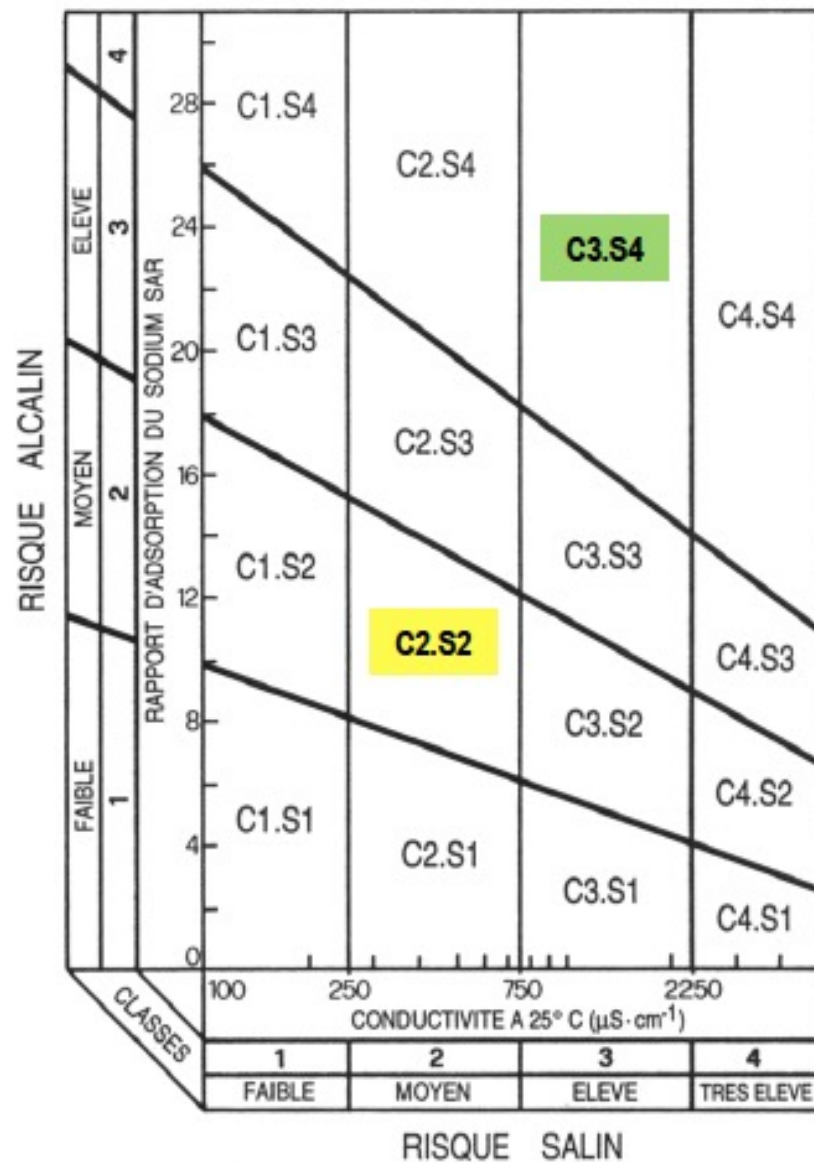
Lecture 13.2

- Impact of drainage: advantages and disadvantages
- Impact of drainage: direct vs indirect environmental impacts
- Subsidence of soil and causes
- Buffer zones: concept and design criteria (formula not to remember)



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