

Cours CIVIL 469

Synthesis of the course, week #03 (05.03.2025), 4 hours (2h theoretical +2h exercises)

1. Low-head Schemes

- Typologies: inline, block, twin, pier
- With and without diversion
- Dam-factory (barrage-usine)
- Equipment: Kaplan, Bulb, Straflo, small-hydro solutions (S-Kaplan, etc..)
- Net head definition
- Importance of tailwater rating curves
- Interdependence between powerhouse and spillway operation
- Power Duration curve (PDC)
- 3D Hill diagram for a modern Bulb turbine < > interface with electro-mechanical design
- Intake and spiral casing design vs. approach flow conditions vs. trashrack
- Unit maintenance requirements impacting civil works

2. Methods/tools

- Moody diagram => Darcy-Weisbach (excel file)
- Energy grade lines in generation mode and in pumping mode
- Tailwater rating curves

3. Examples

- a. Example in Switzerland – Hagneck
- b. Example in Switzerland – Grand Ecluse (Délémont)
- c. Example in South America - Santo Antônio (Brazil)
- d. Example in South East Asia – Xayaburi (Laos)

4. Exercise 1

- Low-head hydropower plant (« follower » / no storage)
- High-head pumping scheme