

DEPARTMENT OF WATER RESOURCES & ENVIRONMENTAL ENGINEERING

Bologna Process Course Description Guide — Level 3 (Third Year)

DEGREE PROGRAM
B.Sc. Technical Engineering

ACADEMIC YEAR
Level 3 (Semesters 5 & 6)

TOTAL ECTS CREDITS
60 ECTS

SEMESTER 5 COURSE SPECIFICATIONS

WREE351 Sewerage Networks & Design

6 ECTS | 4 hrs/wk (2 Lect / 2 Design)

Course Description: Estimation of sanitary sewage flows, storm water runoff (Rational Method), hydraulic design of gravity sewers, sewer appurtenances (manholes, drop structures, pumping stations), bedding, and pipeline construction.

Weeks	Core Topics Covered	Learning Outcomes
Weeks 1–5	Wastewater quantity estimation, peak factors, self-cleansing velocity criteria.	Calculate design flows for sanitary sewer systems.
Weeks 6–10	Hydraulic design of circular sewers using Manning's equation and partial flow charts.	Dimension pipe sizes, slopes, and invert elevations.
Weeks 11–15	Stormwater collection networks, manhole spacing, wet well pumping station design.	Complete comprehensive sewerage network layouts.

WREE352 Air Pollution Control Engineering

5 ECTS | 3 hrs/wk (2 Lect / 1 Lab)

Course Description: Sources and atmospheric dispersion of air pollutants, meteorology, stack design, particulate control technology (settling chambers, cyclones, electrostatic precipitators, fabric filters), and gaseous control.

WREE353 Advanced Surface Hydrology

6 ECTS | 4 hrs/wk (3 Lect / 1 Lab)

Course Description: Advanced hydrologic modeling, rainfall-runoff relationships, Muskingum channel routing, reservoir operation routing, statistical hydrology, flood frequency analysis (Gumbel, Log-Pearson III), and climate change impacts.

Weeks	Core Topics Covered	Learning Outcomes
Weeks 1–5	Continuous hydrologic modeling, Muskingum flood routing equations.	Route hydrographs through rivers and reservoirs.
Weeks 6–10	Frequency analysis, return periods, fitting probability distributions.	Estimate design floods for 50/100-year return periods.
Weeks 11–15	Application of HEC-HMS software for watershed hydrologic simulation.	Build digital hydrological basin models.

WREE354 Advanced Hydraulic Applications

6 ECTS | 4 hrs/wk (3 Lect / 1 Lab)

Course Description: Pipe network analysis (EPANET software), water hammer phenomena, surge tanks, pump characteristics, parallel/series pumps, cavitations, and unsteady flow transients in closed conduits.

WREE355 Environmental Thermodynamics

7 ECTS | 4 hrs/wk (3 Lect / 1 Tut)

Course Description: First and second laws of thermodynamics, closed and open systems, energy balance equations, entropy, phase equilibria, psychrometrics, heat transfer mechanisms (conduction, convection, radiation) in environmental media.

SEMESTER 6 COURSE SPECIFICATIONS

WREE361 Wastewater Treatment Plant Design

7 ECTS | 5 hrs/wk (3 Lect / 2 Design)

Course Description: Wastewater characterization, preliminary treatment (screens, grit chambers), primary sedimentation, biological treatment (activated sludge, trickling filters, oxidation ponds), secondary clarification, and sludge handling.

Weeks	Core Topics Covered	Learning Outcomes
Weeks 1–5	Screening, grit removal, flow equalization, primary clarifier design.	Size physical wastewater treatment units.
Weeks 6–10	Activated sludge kinetics (F/M ratio, SRT, aeration design, secondary settling).	Design biological aeration tanks & clarifiers.
Weeks 11–15	Sludge digestion, thickening, dewatering, and disinfection (chlorination/UV).	Develop complete WWTP flowsheets & sizing.

WREE362 Groundwater Hydrology

6 ECTS | 4 hrs/wk (3 Lect / 1 Lab)

Course Description: Occurrence of groundwater, aquifer types (confined, unconfined), governing differential equations of groundwater flow, well hydraulics (steady/unsteady flow to wells, Theis and Cooper-Jacob methods), and pumping tests.

Weeks	Core Topics Covered	Learning Outcomes
Weeks 1–5	Aquifer properties (Transmissivity, Storativity), Dupuit-Forchheimer assumptions.	Analyze steady 1D and 2D groundwater movement.
Weeks 6–10	Unsteady well hydraulics, Theis non-equilibrium curve matching, Cooper-Jacob analysis.	Determine aquifer parameters from pumping test data.
Weeks 11–15	Well interference, boundary effects, salt-water intrusion in coastal aquifers.	Optimize wellfield locations and pumping rates.

WREE363 Reinforced Concrete Design

6 ECTS | 4 hrs/wk (3 Lect / 1 Tut)

Course Description: ACI code strength design method, ultimate flexural behavior of singly/doubly reinforced rectangular beams, T-beams, shear reinforcement design, one-way slabs, and short column design for water-retaining structures.

WREE364 Foundation Engineering

6 ECTS | 4 hrs/wk (3 Lect / 1 Tut)

Course Description: Bearing capacity theories (Terzaghi, Meyerhof), settlement calculations (immediate & consolidation), shallow foundation design (isolated, combined, raft), lateral earth pressures, retaining walls, and pile foundations.

WREE365 Numerical Analysis

5 ECTS | 3 hrs/wk (2 Lect / 1 Lab)

Course Description: Numerical solutions of non-linear equations, systems of linear algebraic equations, polynomial interpolation, numerical integration (Trapezoidal, Simpson's), and finite difference methods for differential equations.