

DEPARTMENT OF WATER RESOURCES & ENVIRONMENTAL ENGINEERING

Bologna Process Course Description Guide — Level 4 (Fourth Year)

DEGREE PROGRAM
B.Sc. Technical Engineering

ACADEMIC YEAR
Level 4 (Semesters 7 & 8)

TOTAL ECTS CREDITS
60 ECTS

SEMESTER 7 COURSE SPECIFICATIONS

WREE471 Design of Water Treatment Plants

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

Course Description: Process design of municipal water treatment units: flash mixers, flocculators (mechanical & hydraulic), sedimentation basins (plate/tube settlers), rapid sand filters, backwashing systems, and disinfection (chlorination contact tanks).

Weeks	Core Topics Covered	Learning Outcomes
Weeks 1–5	Coagulation kinetics, rapid mixing chambers, paddle flocculator hydraulic design.	Calculate velocity gradients (G) & detention times.
Weeks 6–10	Settling column analysis, rectangular/circular clarifiers, weir loading rates.	Design sedimentation basins & inlet/outlet zone layout.
Weeks 11–15	Filter media hydraulics, headloss equations, backwash hydraulics, sludge treatment.	Complete full layout & hydraulic profile of WTP.

WREE472 Design of Hydraulic Structures I

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

Course Description: Subsurface flow beneath hydraulic structures, Lane's weighted creep and Bligh's theory, Khosla's theory of independent variables, weir design on permeable foundations, and stilling basin energy dissipators.

WREE473 Open Channel Hydraulics

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

Course Description: Uniform flow in open channels (Manning/Chezy), most hydraulically efficient cross-sections, specific energy and critical depth, non-uniform gradually varied flow (GVF profiles), and rapidly varied flow (hydraulic jump).

Weeks	Core Topics Covered	Learning Outcomes
Weeks 1–5	Channel geometric properties, uniform flow computation, optimal cross-sections.	Design economical trapezoidal and circular channels.
Weeks 6–10	Specific energy, alternate depths, critical flow, subcritical/supercritical flow controls.	Analyze channel transitions, drops, and sluice gates.
Weeks 11–15	Gradually Varied Flow (M1, M2, S1 profiles), direct step method, hydraulic jump energy loss.	Compute water surface profiles & jump stilling basins.

WREE474 Design of Gravity Irrigation Systems

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

Course Description: Soil-water-plant relationships, crop water requirements (Penman-Monteith method), irrigation efficiency, design of surface irrigation systems (basin, border, furrow), land levelling, and main canal alignment.

WREE475 Engineering Project I

5 ECTS | 3 hrs/wk (Capstone Capstone Project)

Course Description: First stage of senior design project. Selection of engineering problem, literature review, site data collection, formulation of methodology, and preliminary field/lab investigations.

SEMESTER 8 COURSE SPECIFICATIONS

WREE481 Design of Hydraulic Structures II

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

Course Description: Hydraulic design of dams (gravity dams, earth fill dams), stability analysis, seepage through embankment dams (phreatic line determination), spillways (ogee, side-channel), and canal regulators.

Weeks	Core Topics Covered	Learning Outcomes
Weeks 1–5	Gravity dam loads (water pressure, uplift, earthquake), overturning and sliding stability.	Perform stability analysis for concrete gravity dams.
Weeks 6–10	Earthfill dam seepage, Casagrande construction, toe drain & filter design.	Compute seepage discharge & draw phreatic lines.
Weeks 11–15	Spillway hydraulic rating curves, crest profiles, cross regulators & head regulators.	Design safe spillways & canal headworks.

WREE482 Design of Sprinkler & Drip Irrigation

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

Course Description: Pressurized irrigation technology. Sprinkler system design (nozzle selection, lateral/mainline sizing, pressure uniformity), drip irrigation (emitter selection, filtration units, fertigation, friction headloss in micro-tubes).

WREE483 Soil & Groundwater Pollution

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

Course Description: Contaminant transport phenomena in unsaturated and saturated zones (advection, dispersion, sorption, biodegradation), plume modeling, Environmental Impact Assessment (EIA), and site remediation technologies.

WREE484 Project Management & Engineering Economy

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

Course Description: Time value of money, present worth analysis, rate of return, cash flow diagrams, project scheduling techniques (CPM/PERT network analysis), quantity surveying, cost estimation, and contract specifications.

WREE485 Engineering Project II

7 ECTS | 4 hrs/wk (Capstone Design & Thesis)

Course Description: Execution of final design calculations, numerical simulations/modeling, experimental testing, technical report drafting, and formal oral defense before an academic examination committee.