



National University of Engineering (UNI)

School of Civil Engineering
Syllabus 2027-I

1. COURSE

CE3C6. Risk and Environmental Impact Assessment (Mandatory)

2. GENERAL INFORMATION

2.1 Course	: CE3C6. Risk and Environmental Impact Assessment
2.2 Semester	: 9 th Semester.
2.3 Credits	: 4
2.4 Hours	: 2 HT; 4 HP;
2.5 Duration of the period	: 16 weeks
2.6 Type of course	: Mandatory
2.7 Learning modality	: Face to face
2.8 Prerequisites	: CE3H4. Water Resources. (8 th Sem)

3. PROFESSORS

Meetings after coordination with the professor

4. INTRODUCTION TO THE COURSE

Environmental Risk and Impact Assessment introduces the systematic process for identifying, predicting, evaluating, and mitigating the environmental effects of civil engineering projects before major decisions are taken, together with the identification of environmental hazards and risk sources and the use of probability-consequence risk matrices to prioritize them and formulate environmental risk management and contingency plans. The course also develops the specialized assessment of impacts on rivers, coastal and maritime zones, and lakes or reservoirs that are characteristic of water resources infrastructure. It covers the EIA process (screening, scoping, impact prediction, mitigation, and public participation), environmental risk assessment, sustainability metrics and multi-criteria decision analysis, and the Peruvian regulatory and permitting framework (ANA, SENACE, DICAPl) that governs water-body-adjacent works.

5. GOALS

- Apply the stages of a standardized Environmental Impact Assessment process to a civil engineering project.
- Predict and evaluate the environmental impacts of a project on air, water, soil, and ecological systems.
- Design mitigation measures and environmental management plans for identified impacts.
- Identify environmental hazards and risk sources, and apply a risk matrix to prioritize the environmental risks of a project.
- Assess the specific hydromorphological and ecological impacts of works sited in fluvial, maritime, and lacustrine environments.
- Determine ecological flow requirements and apply the Peruvian permitting framework for water-body-adjacent projects.

6. COMPETENCES

ABET-2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (Usage)

7. TOPICS

Unit 1: Environmental Impact Assessment and Sustainability Metrics (40 hours)	
Competences Expected: ABET-2	
Topics	Learning Outcomes
• EIA process: screening, scoping, impact analysis, mitigation, and public participation • Impact prediction methods for air, water, soil, noise, and ecological systems • Mitigation hierarchy and design of environmental management plans • Legal and institutional frameworks for EIA • Sustainability concepts and the triple bottom line (environment, economy, society) • Cumulative impact assessment and strategic environmental assessment (SEA) • Social impact assessment and stakeholder engagement methods • Sustainability metrics and indicator frameworks (e.g., SDGs, Envision) • Decision-support tools and multi-criteria analysis for sustainable design • Identification of environmental hazards and risk sources associated with a civil engineering project • Environmental risk assessment methodology: probability x consequence matrices and risk prioritization • Development of environmental risk management and contingency plans integrated into the EIA process	• Outline the key stages of a standardized Environmental Impact Assessment (EIA) process [Familiarity] • Predict primary environmental impacts of a proposed infrastructure project on local air and water quality [Usage] • Develop mitigation measures for identified significant environmental impacts [Assessment] • Explain the legal requirements and purpose of EIA in the project approval process [Familiarity] • Apply the triple bottom line framework to evaluate a simple engineering project [Assessment] • Conduct a scoping exercise to define the boundaries and key issues for a cumulative impact assessment [Assessment] • Design a stakeholder engagement plan for a controversial development project [Usage] • Select appropriate sustainability metrics to track the performance of a green infrastructure project [Assessment] • Use a simple multi-criteria decision analysis (MCDA) tool to compare alternative project designs [Usage] • Identify the environmental hazards and risk sources of a civil engineering project [Familiarity] • Apply a risk matrix (probability x consequence) to prioritize the environmental risks of a project [Usage] • Formulate an environmental risk management and contingency plan integrated into a project's EIA [Assessment]
Readings : [Glasson2019]	

Unit 2: Environmental Impact Assessment in Fluvial, Maritime, and Lacustrine Environments (32 hours)	
Competences Expected: ABET-2	
Topics	Learning Outcomes
• Impacts of river-adjacent works (bridges, bank protection, dredging) on fluvial morphology, sediment regime, and aquatic habitat • Impacts of port, coastal, and marine works on currents, sediment transport, water quality, and marine ecosystems • Impacts of works on lakes and reservoirs: eutrophication, thermal stratification, sedimentation, and littoral habitat alteration • Environmental (ecological) flow requirements for rivers affected by water infrastructure • Peruvian permitting framework for water-body-adjacent works (ANA water-use and discharge authorizations, SENACE certification, DICAPI maritime/river-navigation clearance)	• Explain the hydromorphological and ecological impacts specific to fluvial, maritime, and lacustrine environments [Familiarity] • Assess the environmental impact of a river-, coastal-, or lake-adjacent civil work on its aquatic environment [Usage] • Determine the ecological flow requirements for a river reach affected by a water infrastructure project [Assessment] • Identify the Peruvian permitting requirements applicable to a water-body-adjacent project [Usage]
Readings : [Glasson2019]	

Unit 3: Climate Adaptation Engineering for Water Systems (16 hours)	
Competences Expected: ABET-2	
Topics	Learning Outcomes
• Climate science fundamentals and downscaling of global climate model projections • Hydrologic impacts of climate change: precipitation intensity, drought, and snowmelt • Vulnerability and risk assessment frameworks for water infrastructure • Water supply system adaptation: source diversification and demand management • Stormwater system adaptation for increased intensity rainfall • Coastal adaptation strategies: managed retreat, protective structures, and nature-based solutions • Decision-making under uncertainty and adaptive management pathways • Infrastructure design standards and codes under non-stationary climate conditions • Economic appraisal of adaptation options and financing mechanisms	• Interpret downscaled climate projections for key hydrologic variables [Familiarity] • Assess the vulnerability of a water supply system to projected changes in drought frequency [Assessment] • Redesign a stormwater culvert for increased design rainfall intensity based on climate projections [Usage] • Describe adaptation strategies for managing urban water demand under water scarcity [Familiarity] • Compare hard and soft (nature-based) engineering options for coastal flood protection [Assessment] • Develop an adaptive management plan for a reservoir facing uncertain future inflow regimes [Usage] • Propose revisions to infrastructure design standards to incorporate climate resilience [Assessment] • Conduct a cost-benefit analysis for a portfolio of water infrastructure adaptation measures [Usage]
Readings : [Glasson2019]	

8. WORKPLAN

8.1 Methodology

Individual and team participation is encouraged to present their ideas, motivating them with additional points in the different stages of the course evaluation.

8.2 Theory Sessions

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

8.3 Practical Sessions

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

9. EVALUATION SYSTEM

***** EVALUATION MISSING *****

10. BASIC BIBLIOGRAPHY