



Second semester 2021

Rural Hydro-Energy Challenges in Latin America (IING2101)

Instructors

Prof. Catalina Ramírez (Universidad de los Andes - Colombia)
Prof. Alejandro Marañón (Universidad de los Andes - Colombia)
Prof. Jorge Escobar (Pontificia Universidad Javeriana - Colombia)
Prof. Jesús Piña (Instituto Politécnico Nacional - México)
Prof. Luis Vargas (Universidad de Chile - Chile)

General information

- Initial and final dates: August 9th, 2021 - December 4th, 2021
- Days: Tuesday and Thursday
- Time: 8:00am - 9:15am (Colombian time)
- Language: English
- Credits¹: 3
- Grade Type: Numeric - 1.5 to 5.0 (Minimum grade for approved the course: 3.0)
- Course level: undergraduate (sophomore year)

Course topics

The topics of the course are frame within the STEM (Science-Technology-Engineering-Mathematics) field and oriented towards UN Sustainable Development Goals with a broad-spectrum of subjects rather than limited to a specific technology or discipline. The topic of the course in the 2022-2 version is Rural Hydro-Energy Challenges in Latin America.

Learning objectives

At the end of the course, the student will be able to:

- Work efficiently as part of a team to solve complex problems.
- Apply technical knowledge to design solutions for rural Hydro-Energy challenges.
- Communicate ideas in English that contribute to the conception and basic design of engineering solutions.

¹ Uniandes credit: 48 hours of study during a 16-week academic semester.

- Work autonomously to study technical scientific material that may be required to produce solutions to environmental challenges related to water and energy.
- Work in intercultural teams to conceive technological solutions to community problems related to energy and water adjusted to specific socio-economic contexts.

Thematic area

This course will cover four technical areas:

a) Water resource management

The problem of the water resources management is transversal to all societies and is a very topical challenge. In this course you can review the main management strategies and also include good practices in communities in the region. For example, the management of the community of Guavio, Colombia, where there are interesting contributions in the Colombian paramo area. This topic will be complemented with the use of computational techniques for the integrated water resources management. This area will be led by prof. Catalina Ramirez (Universidad de los Andes) and prof. Jorge Escobar (Pontificia Universidad Javeriana).

b) Renewable energies

It considers a review of the main technologies for generating electrical energy from renewable resources, such as solar, wind, hydro, geothermal and biomass energy. The module can be oriented so that students develop a specific project in a rural town in the region. This will be led by prof. Luis Vargas (Universidad de Chile).

c) Solar Energy in Architectural Projects.

This module deals with the integration of clean and sustainable technologies to obtain buildings that reduce the consumption of conventional energy. The student will recognize the problems generated by conventional energy sources and will identify the avant-garde energy alternatives for their integration into architectural projects. This will be led by prof. Jesus Piña (Instituto Politécnico Nacional).

In addition, there will be workshops on team building and innovation, which are considered transversal to all modules. The theme of innovation encourages the creativity of students to solve a specific challenge. For this, teamwork techniques can be used, using computer programs and tools in conjunction with the facilities provided by digital connectivity today. This topic will be led by prof. Alejandro Marañón (Universidad de los Andes).

Methodological aspects

This course will focus on solving a technological challenge in groups of 5 students during the semester. The challenge consists of the solution of a specific problem, which will be chosen from a list of three Hydro-Energy challenges in rural communities in Latin America. The rural communities are the following:

- Nueva Venecia, in the Ciénaga de Pajara, Colombia.
- Huatacondo, Tarapacá Region, Chile.
- Municipio de San Felipe. México.

In each of these locations, Hydro-Energy challenges will be presented, which will be addressed by students during the course of the semester. As explained before, topics related to water will be coordinated by prof. Catalina Ramírez (Universidad de los Andes) and prof. Jorge Escobar (Pontificia Universidad Javeriana), while those related to energy will be coordinated by prof. Jesús Piña (Instituto Politécnico Nacional) and prof. Luis Vargas (Universidad de Chile).

On the other hand, matters related to teamwork coordination, work software (Tandem, Menti, etc.), as well as the design of evaluations and project presentations will be coordinated by prof. Alejandro Marañón (Universidad de los Andes).

The CDIO (Conceive Design Implement Operate) approach was chosen as a reference framework for this COIL course. Accordingly, active learning tools, group project development and problem-based learning (challenges) will be used. The components of the CDIP approach are the following:

- i. Conceive. Students work on understanding the scope of the challenge from the Hydro-Energy point of view and the concepts of sustainability.
- ii. Design. Theoretical and practical elements are provided to the students, so they can make a technical proposal that solves Hydro-Energy challenges in a sustainable way.
- iii. Implement. Students work on identifying implementation techniques of the proposed solutions.
- iv. Operate. Students identify the main operational challenges that the proposed solutions must face.

Weekly activities.

The initial week of the course is planned as follows:

- i. Class 1 (Tuesday): a brief introduction to the course will be presented, which will describe the SDG topics, background on the Magalhaes network, and the main motivations for developing this project, as well as the objectives to be pursued.

Next, the three selected rural communities will be presented, along with their corresponding Hydro-Energy challenges.

Instructors will provide additional material to complement the presentations (readings / videos / supplementary material). At the end of the class, students will be asked to read the material and form an idea of their preferences for working on the course.

- ii. Class 2 (Thursday): the class will be led by Professor Marañón, who will deliver notions about teamwork, methodology and leadership. Also, the working groups of the course will be formed.

All other classes will include a combination of short lectures on specific topics of relevance for the solution of the challenge, teamwork sessions during which the instructors monitor the progress of the groups, and evaluation activities.

The last three classes of the course will be devoted to the presentation of the final projects by each team. All students will participate, as the idea is that all the course gets benefited from the projects developed during the semester.

Evaluation

The evaluation of the course is based on the work developed by each group as well as personal performance. Groups must propose an innovative solution to the chosen problem and elaborate a report and provide a presentation.

The evaluation process is based on three pillars:

- i. Individual Performance (IP). A small test will be carried out at the beginning of a class (to be defined), which will consist of individual questions that must be answered (Mentis or another interactive tool can be used).

Likewise, students will be asked to write a short essay (one page) as a personal reflection on the progress of the course at each stage (CDIO).

- ii. Team Performance (TP). This includes three concepts: preparedness activities, workshops and final project. Preparedness activities refer to the work done by groups to meet challenges. Short videos of 3 to 5 minutes will be requested, where students explain their ideas and progress.

The workshops will be held throughout the semester and will be evaluated at the end of each the CDIO stage.

The final projects will be evaluated through a final report and presentation. Thus, students must write a final report and also make a 15 min presentation in front of the entire progress of their work.

- iii. Intra-Team Performance (ITP). Each student evaluates the performance of their peers in the same group by awarding them a single grade for this concept.

The following general evaluation structure is proposed:

Performance area	Percentage	Total Percentage
1. Individual Performance (IP)		30%
Individual questions	80%	
short essay (one page)	20%	
2. Team Performance (TP)		50%
Preparedness activities	30%	
Workshops	30%	
Final project	40%	
3. Intra-Team Performance (ITP)		20%
Peer evaluation	100%	

The final grade (FG) of the course will be obtained as:

$$FG = 0.3x IP + 0.5x TP + 0.2xITP$$

References

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- Ramírez, M. C., Espinosa, E. E., Cárdenas, J. C., Payán, L. F., Peralta, M., Gámez, F. A., Torres, A. F. (2020). Acceso a agua potable en comunidades rurales de Colombia. Revista de Ingeniería Universidad de los Andes. Vol 49, pp 76-83.
- Diaz A. E. (2020) Agua a la vereda: Una estrategia de cohesión social para la ampliación de cobertura y acceso al agua en el sector rural. Acceso a agua potable en comunidades rurales.
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- Sommer, A. (2012). Managing Green Business Model Transformations. Heidelberg, Germany: Springer-Verlag, Pp. 93-106.

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- Acero, A.E., Ramirez Cajiao, M.C., Peralta Mejia, M., Payán Durán, L.F. & Espinosa Díaz, E.E. (2018) Participatory Design and Technologies for Sustainable Development: An Approach from Action Research. *Systemic Practice and Action Research*, 1–25. doi: 10.1007/s11213-018-9459-6
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Additional Information

Statement on the MAAD Program

Any member of the Uniandes community who is subject to, witnesses or is aware of a conduct of abuse, harassment, threatening, discrimination or sexual or gender violence (MAAD in the Spanish original) must make the University aware of the case. This is in order to be able to take institutional actions to manage the case in light of the protocol's provisions, looking after the well-being of the people affected.

To report a case and receive support, you may contact:

1. MAAD Line: lineamaad@uniandes.edu.co
2. Ombudsperson's Office: ombudsperson@uniandes.edu.co
3. Dean of Students: centrodeapoyo@uniandes.edu.co
4. PACA (Peer Support against Harassment): paca@uniandes.edu.co
5. Student Council of Universidad de los Andes (CEU in the Spanish original): comiteacosoceu@uniandes.edu.co

Reasonable Adjustments Clause

‘The objective of reasonable adjustments is to eliminate possible visible or invisible barriers that prevent to fully develop the right to education. In current circumstances, the reasonable adjustment protocol is adapted to consider the specific difficulties students face, including connectivity barriers, barriers to adequate technological resources and barriers to the physical and mental health of students or their family members, all of which exacerbate confinement.

If you consider it necessary or important, feel free to tell your professor as soon as possible if there is a barrier or difficulty, among the abovementioned indications, and require some type of reasonable adjustment to be in equal conditions with other students.” [Taken from the curriculum of the course “Colombia: space, time, difference,” Professor Ricardo Kerguelén].

Policy for difficult times

People can go through difficult times, which can affect life at the University. These may be problems at home, with friends, family members or partners, or any other causes of stress. If you feel you are going through a difficult time, no matter the reason, please feel free to talk to your professor to ask for support. No work or deadline is more important than your mental and physical health.