NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ENVIRONMENTAL ENGINEERING

ENVIRONMENTAL ENGINEERING PROGRAM

GA131 – SOLID WASTE MANAGEMENT AND ENGINEERING

I. GENERAL INFORMATION

CODE	**:**	GA131 – Solid Waste Management and Engineering
SEMESTER	**:**	
CREDITS	**:**	04
HOURS PER WEEK	**:**	05 (Theory – Laboratory)
PREREQUISITES	**:**	GA101
CONDITION	**:**	Mandatory

II. COURSE DESCRIPTION

The course of Solid Waste Management and Engineering is a discipline of basic scientific training that is taught in a theoretical and practical way. It contains in its first part the legal aspects related to the management of solid waste and its implication with the environment; then it is analyzed through environmental management instruments (PAMA, PIGARS, PMRS, etc.), the proper management of solid waste at the municipal level, it also studies the operational aspects that lead to the development of Environmental Impact Studies of infrastructure solid waste according to the laws in force and are necessary for the projects of manual, semi-mechanized and mechanized sanitary landfills. In addition, technical and operational aspects of solid waste management processes are developed, from generation to final disposal.

The Solid Waste Management and Engineering course is purely participatory and applications to real cases, the students must develop workshop and practical work with the maximum effort; It presents qualified practices, field visits and collective participation activities.

III. COURSE OUTCOMES

General outcomes:
At the end of the course the student will:

- Motivate the study of the processes involved in solid waste management at the municipal level, as part of their professional training

- Encourage interest in research into new technologies in the management of solid waste at the municipal level.

- Know and develop viable alternatives for the integral management of solid waste at the municipal level taking into consideration the care of the environmental aspects involved.

Specific outcomes:
At the end of the course the student will:

- Develop and manage the environmental aspects that derive from the development and execution of municipal solid waste management projects.

- Know and use environmental management instruments in relation to the operation and maintenance of municipal solid waste management processes.

- Identify the technical and operational aspects necessary for the solution of situations that lead to poor management of municipal solid waste.

IV. LEARNING UNITS

The theoretical part of the course will consist of the development of 9 chapters related to the management of solid waste; these are:
Chapter 1: introduction, basic concepts on the subject of solid waste.

- **Chapter 2:** Legal Basis in Solid Waste Issues.
- **Chapter 3:** Characterization of Solid Waste.
- **Chapter 4:** Public Cleaning and Management Instruments.
- **Chapter 5:** Public Cleaning and Manual and Mechanized Sweeping.
- **Chapter 6:** Public Cleaning and the Collection and Transport of Waste.
- **Chapter 7:** Management of Transfer Stations.
- **Chapter 8:** Management and Implementation of Landfills
- **Chapter 9:** Operation and Maintenance of Sanitary Landfills

The course will analyze and review concepts related to the Integral Management of Solid Waste at the municipal level, however some concepts of solid waste management from the Non-municipal area will be revised to relate them to the previous ones; The concepts that will be related to the topics dictated in class are:

Dump. Inadequate accumulation of solid waste in roads and public spaces, as well as in urban, rural or vacant areas that generate health or environmental risks. They lack sanitary authorization.

Declaration of solid waste management. Administrative technical document with the character of an affidavit, signed by the generator, by means of which he declares how he has managed or will handle the solid waste under his responsibility during the following period. This statement describes the solid waste management system of the company or generating institution and understands the characteristics of the waste in terms of quantity and hazard; operations and processes executed and to be executed; modality of execution of the same and the administrative aspects determined in the corresponding forms.

DEI. It is an environmental Instrument whose acronym means Declaration of Environmental Impact.

Final disposition. Processes or operations to treat or dispose of solid waste in one place as the last stage of its management in a permanent, sanitary and environmentally safe manner.

EIS. It is an environmental Instrument that means Environmental Impact Study.

Company providing solid waste services. Legal entity that provides solid waste services through one or more of the following activities: cleaning of roads and public spaces, collection and transport, transfer, treatment or final disposal of solid waste.

Solid waste generator. Natural or juridical person that due to its activities generates solid waste, be it as producer, importer, distributor, merchant or user. The possessor of hazardous solid waste will also be considered as a generator, when the real generator and the municipal governments can not be identified from the collection activities.

Solid waste management. All technical administrative activity of planning, coordination, coordination, design, application and evaluation of policies, strategies, plans and action programs for the proper management of solid waste at the national, regional and local levels.

Management instruments. They are the set of measures strategically organized, which allow directing the resources available to achieve the objectives proposed in the policies. These in turn respond to principles formulated according to the vision of society that is intended to be achieved.

Solid waste management. All operative technical activity of solid waste that involves handling, conditioning, transport, transfer, treatment, final disposal or any other technical operating procedure used from generation to final disposal.

Integrated management of solid waste. It is a set of regulatory, financial and planning actions that apply to all stages of solid waste management since its generation, based on environmental health criteria and technical and economic feasibility for the reduction in the source, use, treatment and the final disposal of solid waste.

Manifesto management of hazardous solid waste. Technical administrative document that facilitates the tracking of all hazardous solid waste transported from the place of generation to its final disposal. The management manifesto of hazardous solid waste must contain information regarding the source of generation, the characteristics of the generated waste, transport and final disposal, consigned in special forms that are subscribed by the generator and all the operators that participate until the final disposal of said waste.

Minimization of solid waste. Action to reduce to the minimum possible the volume and danger of solid waste, through any preventive strategy, procedure, method or technique used in the generating activity.

Solid waste operator. Natural person who performs any of the operations or processes that make up the management of solid waste, and may or may not be the generator of the same.

Plant or transfer station. Installation in which the solid waste of the trucks or collection containers is temporarily unloaded and stored, and then continue with their transport in units of greater capacity.

PAMA. It is an environmental Instrument whose acronym means Program of Adaptation and Environmental Management of Solid Residues.

PIGARS. It is an environmental instrument whose acronym stands for Comprehensive Plan for Environmental Management of Solid Waste.

Reuse of solid waste. Return to obtain a benefit of the good, article, element or part thereof that constitutes solid waste. Recycling, recovery or reuse is recognized as a reuse technique.

Recycle solid waste. Any activity that allows to reuse a solid waste through a transformation process to meet its initial purpose or other purposes.

Recovery of solid waste. Any activity that allows to reuse parts of substances or components that constitute solid waste.

Landfill. Installation for the sanitary and environmentally safe disposal of solid waste on the surface or underground, based on the principles and methods of sanitary and environmental engineering.

Agricultural residues. Are those waste generated in the development of agricultural and livestock activities. This waste includes the containers of fertilizers, pesticides, various agrochemicals, among others.

Commercial waste. Are those generated in commercial establishments of goods and services, such as: food supply centers, restaurants, supermarkets, shops, bars, banks, convention centers or shows, work offices in general, among other similar commercial and labor activities . These residues are mainly made up of paper, plastics, various packaging, residues of personal hygiene, cans, among others.

Household waste. Are those waste generated in domestic activities carried out in homes, consisting of food scraps, newspapers, magazines, bottles, packaging in general, cans, cardboard, disposable diapers, rests of personal hygiene and the like.

Residues from construction activities. Are those fundamentally inert waste that are generated in the activities of construction and demolition of works, such as: buildings, bridges, roads, dams, canals and other related to them.

Residues from health care facilities. Are those waste generated in the processes and activities for medical care and research in establishments such as hospitals, clinics, health centers and posts, clinical laboratories, clinics, among others. These residues are characterized by being contaminated with infectious agents or that may contain high concentrations of microorganisms that are potentially dangerous, such as: hypodermic needles, gauze, cottons, culture media, pathological organs, food remains, papers, packaging, material of laboratory, among others.

Waste of facilities or special activities. Are those solid waste generated in infrastructures, normally of great dimension, complexity and risk in their operation, in order to provide certain public or private services, such as: water treatment plants for human consumption or wastewater, ports, airports, land terminals, shipping and military facilities, among others; or of those public or private activities that mobilize human resources, equipment or infrastructures, in an eventual manner, such as musical concerts, health campaigns or other similar activities.

Waste from cleaning public spaces. Are those waste generated by the services of sweeping and cleaning of tracks, trails, squares, parks and other public areas.

Industrial waste. Are those waste generated in the activities of the various industrial branches, such as: mining, chemical, energy, fishing and other similar manufacturing. This waste is presented as: sludge, ash, metal slag, glass, plastics, paper, cardboard, wood, fibers, which are usually mixed with alkaline or acidic substances, heavy oils, among others, including in general the waste considered hazardous.

Shared responsibility. It is a system in which each person is attributed responsibility for the waste generated or managed in the different stages of the life of a product or the development of an activity in which it intervenes.

Reuse of solid waste. Any activity that allows to directly reuse the good, article or element that constitutes the solid waste, with the purpose of fulfilling the same purpose for which it was originally elaborated.

Significant risk. High probability of occurrence of an event with undesirable consequences for health and the environment.

Segregation. Action of grouping certain components or physical elements of solid waste to be managed in a special way.

Treatment. Any process, method or technique that allows to modify the physical, chemical or biological characteristic of solid waste, in order to reduce or eliminate its potential danger of causing damage to health and the environment.

V. LABORATORIES AND PRACTICAL EXPERIENCES

- Legislation and Characterization of Solid Waste.
- Management instruments and manual sweeping - machining.
- Collection - Transportation and Transfer Stations.
- Sanitary landfills, operation and maintenance management.
- Monograph or work with assigned subject that will be presented in a staggered manner; In total there are 4 partial presentations of progress, prior to the final presentation.
- Visualization of videos of waste management, interpretation and analysis.
- Interpretation of rules on solid waste.
- Interpretation of the need for transfer stations.
- Memory of the useful life of Sanitary Landfills.
- Visit to the sweep and collection service of private administration.
- Visit to a sanitary landfill.

VI. METHODOLOGY

Classes are developed through teacher presentations, with active participation of students, encouraged through real situations. The participation of the students and their interaction with the course will be given through workshops and field visits. The evaluation of real cases presented by the students through the execution of technical works will also be promoted.

VII. EVALUATION FORMULA

The learning will be evaluated through the "I" system.

- Partial Exam (PE): Weight 1
- Final Exam (FE): Weight 1
- Average of Practices (P) / Monographic Work (P5): Weight 1.

$$\boldsymbol{FA} = \frac{\boldsymbol{PE} + \boldsymbol{FE} + ((\boldsymbol{P1} + \boldsymbol{P2} + \boldsymbol{P3} + \boldsymbol{P4} + \boldsymbol{P5} - \boldsymbol{MIN}\ (\boldsymbol{P1}, \boldsymbol{P2}, \boldsymbol{P3}, \boldsymbol{P4}))/\boldsymbol{4})}{\boldsymbol{4}}$$

VIII. BIBLIOGRAPHY

- General Law on Solid Waste (Law No. 27314), Health Ministry. (2000)
- Modification of the General Law on Solid Waste, through Legislative Decree No. 1065. Health Ministry. (2008)
- Regulation of the General Law of the RRSS (D.S.057-2004-PCM). Health Ministry. (2004)
- Guide for the favorable technical opinion of the area selection study for treatment infrastructures, transfer and final disposal solid waste. Health Ministry. (2008)
- Design Guide, Construction, Operation and Maintenance and Closing of Mechanized Sanitary Landfills. Ministry of Environment. (2013)
- Design Guide, Construction, Operation and Maintenance and Closing of Sanitary Landfills Manual. Ministry of Environment. (2013)