



**NATIONAL UNIVERSITY OF ENGINEERING**  
**COLLEGE OF ENVIRONMENTAL ENGINEERING**  
**ENVIRONMENTAL ENGINEERING PROGRAM**

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**GA134 – ENVIRONMENTAL REMEDIATION**

**I. GENERAL INFORMATION**

<b>CODE</b>	: GA134 – Environmental Remediation
<b>SEMESTER</b>	: 8
<b>CREDITS</b>	: 03
<b>HOURS PER WEEK</b>	: 04 (Theory – Practices – Laboratory)
<b>PREREQUISITES</b>	: GA131
<b>CONDITION</b>	: Elective

**II. COURSE DESCRIPTION**

The course prepares the student in the application of environmental remediation concepts. Applicable legislation. Remediation of elements of the physical environment: water, soil, air; biological means: flora, fauna or socio-economic cultural environment: population and infrastructure. Application of the biogeochemistry of microorganisms. Application of nanotechnology in remediation. Public policies and future projects.

**III. COURSE OUTCOMES**

At the end of the course the student will:

- Organize in an adequate way the analysis and interpretation of the different types of environmental remediation, interpreting their characteristics, definitions and knowledge of the methods to be developed.
- Have the capacity to explain and determine the type of remediation that must be applied in each of the problems that arise, both for the quality of water, soil, air, etc.
- Understands and applies the appropriate technical criteria to achieve efficient environmental remediation.
- He has the ability to interpret the different concepts on environmental remediation issues that come his way.

**IV. LEARNING UNITS**

**THEORY**

**First week**

Introduction of environmental remediation in our country. Background of environmental remediation in the world. Definition of environmental remediation. General and Specific Objectives. Methodologies for environmental remediation.

**Second week**

Laws; The oil. Derivatives and oil states. Types of environmental remediation.

**Third week**

Types of environmental remediation. Remediation objectives in soil, water, air; biological means: flora, fauna or socio-economic cultural environment.

**Fourth week**

Soil pollution. Soils contaminated by oil. Types of soil remediation.

**Fifth week**

Water contamination. Drainage of acidic water DAM and DAR. Types of Water Remediation

**Sixth Week**

Air pollution. Particulate material. Carbon capture. Types of air remediation.

**Seventh Week**

Phytoremediation. Phytoremediatory species. Types of phytoremediation

**Eighth Week**

Bioremediation. Remediation microorganisms of contaminants.

**Tenth Week**

Fishing environmental liabilities. Remediation of fishing liabilities

**Eleventh Week**

Agroindustrial environmental liabilities. Remediation of Agroindustrial liabilities

**Twelfth Week**

Environmental remediation in the livestock industry. Bad habits. Concentration of nitrates in water. Exhibitions

**Thirteenth Week**

Desertification of soils due to overgrazing and logging. Restoration with native species and forest. Exhibitions

**Fourteenth Week**

Pollution in the mining industry. Tailings, mining slag. Tailings and slag treatment. Final disposition of tailings, slags and bargains.

**Fifteenth Week**

Closure of mines. Use of geomembranes. Hydraulic filling and packing.

**Sixteenth Week**

Environmental passives. Environmental actives, presence of flora and fauna. Protection and Maintenance

**V. LABORATORIES AND PRACTICAL EXPERIENCES****Practical Experiences**

- What is environmental remediation? Comparison between the different types of remediation.
- Differentiate the types of environmental remediation
- Treatment of soils contaminated by tailings of the UNI.

**Field Trip**

- Field trip to the La Oroyo city

## VI. EVALUATION FORMULA

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

- Partial Exam: Weight 1
- Final Exam: Weight 2
- Qualified Practices Average: Weight 2.  
The three practices with the higher grades will be averaged.

Calculation of the Final Average:

$$FA = \frac{PE + 2 * FE + \frac{2(QP1 + QP2 + QP3)}{3}}{5}$$

PE: Partial Exam; FE: Final Exam, QP: Qualified Practice

## VII. BIBLIOGRAPHY

- MENDENHALL, William. Estadística y Probabilidad para Ingeniería. Editorial Prentice Hall, 2005.
- ALVAREZ, José y TORRES Luis. Probabilidad y Estadística. Editorial Alfa Omega, 2004.