



UNIVERSIDAD LIBRE®

Personería Jurídica No. 192 de 1946 de Mingobierno
Nit.: 860.013.798-5



FREE UNIVERSITY PEREIRA SECTION

UNDERGRADUATE PROGRAM IN ENVIRONMENTAL ENGINEERING



SUBJECT: UNIT PROCESSES II AND LABORATORY

CODE: -----

SEMESTER: **SIXTH**

HOURS **WEEKLY: 6**

THEORETICAL: 4

PRACTICES: 2

REQUIREMENTS: **OPERATIONS AND UNIT PROCESSES I,**
FLUID MECHANICS I

GOALS.

- To ensure that the student identifies and correlates the theoretical foundations of each one of the operations and processes used in the treatment of wastewater, both in theory as in the laboratory.
- That the student knows the physical, mathematical, chemical or biological models that allow to explain the theoretical basis of each of the operations and processes studied





UNIVERSIDAD LIBRE®

Personería Jurídica No. 192 de 1946 de Mingobierno
Nit.: 860.013.798-5



- That the student identifies the characteristics of the different components involved in each of the operations and processes
- That the student determines and correlates the operational and design parameters related in each operation and process.

That the student is able to propose and design procedures

Experimental tests that allow determining polishing loads and parameters optimal design and operation in water treatment.

That the student can experience the validity of the models, the theory of the reactors and kinetic constants established in operations Unitarians.

METHODOLOGY.

The course will be developed with master lectures by the professor on the content basics of the subject; for their part, students will strengthen their knowledge of the subject through recommended readings, consultations with the teacher and problem solving of application.





UNIVERSIDAD LIBRE®

Personería Jurídica No. 192 de 1946 de Mingobierno
Nit.: 860.013.798-5



WORK PROGRAM.

- Oxygen demand (BOD)
- Activated sludge
- Biological filters
- Stabilization lagoons
- Sludge Drying
- Anaerobic Treatments
- Layout on the ground

LABORATORY PRACTICES

1. COAGULATION-FLOCCULATION

- Determination of the type of coagulant and optimal dose.
- Determination of optimal coagulation-flotation conditions, gradient, times,
pH and coagulant concentration

2. SEDIMENTATION





UNIVERSIDAD LIBRE®

Personería Jurídica No. 192 de 1946 de Mingobierno
Nit.: 860.013.798-5



- Determination of the sedimented volume curve as a function of time
- Sedimentation by zones
- Determination of the critical sedimentation velocity
- Removal efficiency as a function of hydraulic load



3. FILTRATION

- Influence of particle size distribution on turbidity removal efficiency
- Comparison of constant rate and declining rate efficiencies
- Filter washing

4. CHLORINATION

- Determination of residual chlorine demand in the laboratory

5. ADSORPTION

- Determination of an adsorption isotherm for given adsorbent conditions and adsorbate

6. PRECIPITATION





UNIVERSIDAD LIBRE®

Personería Jurídica No. 192 de 1946 de Mingobierno
Nit.: 860.013.798-5



Determination of optimal conditions for removing calcium, magnesium and other minerals by precipitation

Chromium from water. Removal of Cr+6 by chemical precipitation



7. WATER STABILIZATION

- Determination of the stabilization pH of water
- Determination of parameters to find the Langelier index
- Laboratory stabilization test

8. ION EXCHANGE

- Determination of the ion exchange capacity of a resin
- operation for the generation of resins

Example of smoothing



LITERATURE.





UNIVERSIDAD LIBRE®

Personería Jurídica No. 192 de 1946 de Mingobierno
Nit.: 860.013.798-5



METCALF & EDDY, Sanitary Engineering. Water Treatment, Disposal, and Reuse

residuals, Editorial Labor, 1985

RAMALHO RS, Introduction to Wastewater Treatment Processes, Academy Press, 1983

ADAMS CE, FORD DL, ECKENFELDER WW, Development of Design and Operational

Criteria for Wastewater Treatment, CBI, 1981

McCABE WL, SMITH JC, Unit Operations of Chemical Engineering, McGraw Hill, 1967

CRUZ LE, DUARTE A., Design and assembly of an operations and processes laboratory

Unitarians. National University of Colombia, Bogotá, 1978

ROMERO R. JAIRO A., Determination of the reaction constant K for the equation of

the BOD

ROMERO R. JAIRO A., Aquatreatment by Stabilization Lagoons

Cubillos Z. Armando, Stabilization Ponds. CIDIAT, Series: Environment and Resources

Renewable Natural Resources, Mérida, 1985

CUBILLOS Z. ARMANDO, Criteria for Sizing Stabilization Ponds. CIDIAT,

Series: Environment and Renewable Natural Resources, Mérida, 1982





UNIVERSIDAD LIBRE®
Personería Jurídica No. 192 de 1946 de Mingobierno
Nit.: 860.013.798-5



GLOYNA E., Wastewater Stabilization Ponds

YAÑEZ F., Advances in wastewater treatment by stabilization lagoons,

CEPIS, Technical Documents Series 7. 1981

MARA DD, Sewage Treatment in Hot Climates, Wiley, 1976

MARAIS GVR, Faecal Bacterial Kinetics in Stabilization

ARTHUR JP, Notes of the Design and Operation of Waste Stabilization Ponds in Warm

Climates of Developing Countries. World Bank, Technical paper No. 7, 1983

ASCE, Engineering Design Variables for the Activate Sludge Process, J EED, ASCE, June

1980, p. 473

