NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF MECHANICAL ENGINEERING
MECHANICAL-ELECTRICAL ENGINEERING PROGRAM

ML713 – HYDROELECTRIC POWER PLANTS

I. GENERAL INFORMATION

CODE	: ML713
SEMESTER	: 9
CREDITS	: 4
HOURS PER WEEK	: 4 (Theory)
PREREQUISITES	: MN233 and ML243
CONDITION	: Mandatory

II. COURSE DESCRIPTION

The course prepares students in the application of science and technology to economically select and design electromechanical main components of a hydroelectric plant, such as penstocks, turbines, alternators, transformers, switching and ancillary services in addition to those who have to implement in the civil works such as dams and jacks. Then the student can outline general programs of operation and maintenance of these plants, taking into account the principles of environmental safety and environmental preservation.

III. COURSE OUTOCOMES

The student:

1. Calculates the magnitudes of the electromechanical equipment for hydroelectric power plants.
2. Determines the technical and economic feasibility of projects of hydroelectric power plants.
3. Applies technical concepts to develop programs for operation and maintenance of hydroelectric plants.
4. Interprets the results of measurements of environmental parameters to make adjustments if values are outside the corresponding legislation.
5. Develops safety standards for operation and maintenance of hydropower plants.

IV. LEARNING UNITS

1. HYDROLOGY / 4 HOURS
   Differences between the basins of the Pacific and Atlantic / Natural Water Cycle / Precipitation, runoff, infiltration, evaporation, water yield / rainfall stations / Stations Capacity: currentmeter, saline dissolutions / Average speed flow in a basin / Determination of nominal and millennial flow / concentration curves and flow duration / application flow problems.

2. CIVIL WORKS / 4 HOURS

   Natural lagoons / damp types / intake buildings: thick screening, fine screening, drippers, sanders, spillways / Adduction galleries to free hair and pressure: Tunnel canals, windows / Load chamber maximum volume / fireplace balance / Water hammer treatment / Application problems.

3. ELECTRIC MARKET RESEARCH / 4 HOURS

   Analysis of the demand evolution and projection / Load Diagram Types / Load factor, plant factor, real time operation, utilization factor / Isolated and interconnected systems / International electrical interconnections / Application Problems.

4. Penstocks / 6 HOURS

   Pressure ducts / Construction and installation / Calculation of diameter and thickness / Accessories of penstocks: Expansion and push joints, supports, anchors / Gauges / Piques / Safety Valves, operation and maintenance / Water hammer / Closing and opening times of the shutter bodies and turbines / application problems.

5. POWER PLANT / 12 HOURS

   Generation elements / Turbines selection / Synchronous alternators / Exciters / Active power, reactive power, apparent power / Power Transformers / Maneuver elements / Speed and voltage regulators / Auxiliary Services: Electric pumps, compressors, batteries, bridge crane, emergency diesel group, control room, cooling system / Application problems.

6. OPERATION AND MAINTENANCE / 8 HOURS

   Conditions for paralleling alternators and transformers / synchroscopes / Degrees of Statism / Cast Loading / Dispatch optimal load / Factory testing and commissioning of the different components of the generators / Effective Power / Operation in Base Media Base and peak load diagram / Application problems.

7. SAFETY AND ENVIRONMENT / 4 HOURS

Procedures for performing the hydraulic, mechanical and electrical operations / The Five Golden Rules / Opening and closing of maneuvers elements / Use of personal protective equipment / Environmental studies / Conservation and Protection of the environmental basic components: water, air, land and habitat / Illustrative examples.

V. METHODOLOGY

The course is developed in theoretical sessions in which the teacher presents the hydraulic, mechanical and electrical main concepts of Hydropower Plants with various real problems of application. At the end of the course the student must submit and present a monographic work to explain the design and operation of a component of the central. In all sessions active student participation is encouraged.

VI. EVALUATING FORMULA

Evaluation System "F". Calculation of Final Average: PF = (PP + EXP + EXF) / 3
PP: Quizzes Average,
EXP: Midterm Exam,
EXF: Final Exam

VII. BIBLIOGRAPHY

1. VILLANUEVA URE, Reynaldo. Hydropower Plants. Editorial of the National University of Engineering, 2012.
2. JOURNALS OF CIER (Regional Electrical Integration Commission) and the WORLD ENERGY COUNCIL.