NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF MECHANICAL ENGINEERING
MECHANICAL ENGINEERING PROGRAM

MN463 – LABORATORY OF MECHANICAL ENGINEERING II

I. GENERAL INFORMATION

CODE	: MN463 Laboratory of Mechanical Engineering II.
CYCLE	: 7
CREDITS	: 1
HOURS PER WEEK	: 3 (Laboratories)
PREREQUISITES	: MN412 -MN116
CONDITION	: Mandatory

II. COURSE INTRODUCTION

The course prepares the student to be able to experimentally verify the basic theory of Pelton and Francis Hydraulic Turbines, Internal Flows of Air in Pipelines and Water in Copper Pipes, Thermal Balance and performance of the Pyro tubular Steam Generator, Hilton combustion, Ram Jet subsonic operation, Series and parallel pumps, Air Conditioning system.

III. COURSE OUTCOMES

The student:

1. Knows and explains the properties and characteristics of the elements of an Energy System.

2. Understands and applies the main existing laws and properties of an Experimental Teaching Module.

3. Interprets the concepts of fluid properties, combustion, flows and thermal processes.

4. Interprets the results obtained in the Laboratory and prepares a Technical Report group, giving conclusions and relates it to some practical application.

IV. LEARNING UNITS

1. INTRODUCTION:

Formation of Working Groups / List of experiences / Delivery of the Regulation of the Laboratory course / Unit systems / Course syllabus / Evaluation System / Structure of a Technical Report / Technical visit to the different modules to be used in the course.

2. HYDRAULIC TURBINES: PELTON AND FRANCIS

Concept of Hydraulic Turbomachines / Hydraulic Engines / Classification and Criteria for Selection of Hydraulic Turbines / Applications in Hydroelectric Power Plants / Description of Pelton Turbine / Description of Francis Turbine / Differences with other types of turbines.

3. THE INTERNAL FLOW THEORY:

Differences between compressible and incompressible flows / Piezometric lines, primary and secondary losses, Darcy equations / Distribution of velocities in ducts and pipes, laminar and turbulent flow / mean velocity, cut velocity, Prandtl equations, colebroks and others. / Description of Laboratory Centrifugal Fan Ducts / Fan Test for different RPM / Measuring Instruments to be used: Inclined Column Manometer, Differential Micromanometer, Pitot Tube and Tachometer / Description of Copper Piping Bench / Measuring Instruments a Used: Inverted differential pressure gauge of water and mercury column manometer / Measurement of volume in the capacity tank, use of the timer.

4. VAPOR GENERATOR AND COMBUSTION CHAMBER:

Description of boilers and classification / Applications in Thermoelectric Plants and Industrial Processes / Testing in the pirotubular boiler INTESA of the Laboratory of Energy N ° 5 / Thermal Balance and Perfomance of the boiler of the Laboratory. / Description of Combustion and Classification Chambers / Test in the Hilton constant pressure combustion chamber of the Laboratory for different air / fuel ratios using LPG gas as fuel / Applications.

5. SUBSONIC JET RAM:

Open Brayton Cycle / Jet Ram Description and Classification / Stagnation Properties / Laboratory Jet Ram test for different fuel air ratios.

6. LAST GENERATION MODULES: PUMPS IN SERIES AND PARALLEL / AIR CONDITIONING SYSTEM.

Centrifugal pumps and sorting / Pumps in series and parallel / Testing in the Armfield module of pumps in series and parallel / Sensors and control by computer software of Pressure, flow and RPM / Characteristic curves of pumps in series and parallel.

Use of Redwood and Universal Viscometers. Densimeter for oil at different temperatures.

V. LABORATORIES AND PRACTICAL EXPERIENCES

Of the 8 Experiences to be carried out in the cycle, the working groups will present a TECHNICAL REPORT and they will support it orally with preparation of presentations by the work groups, for each experience will be evaluated punctuality, participation, oral test of the experience that is going to implement

VI. METHODOLOGY

The course is developed in sessions of basic theories and practice of Laboratory. In the sessions of basic theory, the teacher presents the concepts, theorems and applications of the topics of the Laboratory. In the practical sessions of the Laboratory, they are experimented with the various modules of the Energy Laboratory No. 5 and with the data collected from the tests, a TECHNICAL GROUP REPORT is produced. In all the sessions, the active participation of the student is promoted.

VII. FORMULA EVALUATION

Evaluation System "D". Calculation of the Final Average of 10 Notes, 8 notes for each Experience, a partial Written Support note of the 4 first experiences and another Final Written Support note of the last 4 experiences.

VIII. BIBLIOGRAPHY

1. POLE ENCINES. Hydraulic Turbomachines. Editorial LImusa, 1975.

2. G.SMITH. Gas turbines and jet propulsion. Editorial Reverte.

3. CLAUDIO MATAIX. Fluid Mechanics and Hydraulic Machines. Editorial Alfaomega.