



# NATIONAL UNIVERSITY OF ENGINEERING

## COLLEGE OF MECHANICAL ENGINEERING

### MECHATRONICS ENGINEERING PROGRAM

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#### **MN465 – MECHANICAL ENGINEERING LABORATORY**

#### I. GENERAL INFORMATION

CODE	: MN 465 Laboratory of Mechanical Engineering
GRADE	: 7
CREDITS	: 1
HOURS PER WEEK	: 3 (Laboratory)
PREREQUISITES	: MN 121 and MN204
CONDITION	: Mandatory

#### II. COURSE SUMMARY

Through the use of instruments and equipment, the student will be able to handle, evaluate and make decisions regarding any eventuality that will be presented to him when he is performing in the labor field. The methodology used is group work so that they can exchange ideas and information about the operation of instruments and equipment. After the realization of the experience the group of students must present a report on it and will take an individual oral support. Each student should present cases of application of the experience, taking as reference what was published in the scientific journal Science Direct.

#### III. COMPETENCES

The student:

1. Recognizes the different instruments of measurement of properties and equipment used in the labor field.
2. Determines the precision and good functioning of the instruments, the efficiency of the equipment in its different blocks.
3. Explains the physical functioning of each instrument and equipment, and its form of evaluation.
4. Interprets the calibration curves of the instruments and the characteristic curves of the equipment.
5. Uses the evaluation standards of the different components used during the laboratory experience.

#### IV. LEARNING UNITS

##### 1. PRESSURE MEASUREMENTS, TEMPERATURE AND POWER ASSESSMENT / 3 HOURS

Calibration of the Bourdon gauge with the Dead Weight Calibrator / Calibration of bulb thermometers, bimetallic, thermocouple in the calibration bench of thermometers / Evaluation of the hydraulic and shaft powers in the Pelton Turbine.

##### 2. FLOW MEASUREMENTS / 3 HOURS

Flow measurements using the Reynolds vat (Orifice, Spillway and Reynolds tube). Use of the orifice plate, venturímetro and capacity tank for the measurement of flows.

##### 3. TWO-STAGE COMPRESSOR / 3 HOURS

Checking energy savings when compressing in stages. Comparison with isothermal compression. Evaluation of electrical power, to the axis and Indicated. Evaluation of indirect contact heat exchangers. Use of the Reynolds tube to measure water flows. Use of the orifice plate to measure the air inlet flow.

##### 4. INTERNAL FLOW / 3 HOURS

The primary and secondary losses for different water flows are determined by the use of the bank of pipes of different diameter for the circulation of water. With a fan coupled with inlet and outlet ducts, the piezometric line is determined using an inclined pressure gauge. With the use of a Pitot tube and a differential pressure gauge, the static, dynamic and total pressures in the cross section of the duct are measured.

##### 5. WATER PUMP TEST / 3 HOURS

Characteristic curves of pumps operating individually. Characteristic curves of pumps running in series. Characteristic curves of pumps running in parallel.

##### 6. REFRIGERATION AND AIR CONDITIONING / 3 HOURS

Evaluation of the refrigeration and air conditioning equipment at different levels of forced convection of the condenser and evaporator.

##### 7. STEAM GENERATOR / 3 HOURS

Evaluation of the steam generator at different load regimes.

##### 8. HEAT EXCHANGER / 3 HOURS

Evaluation of the heat exchanger of concentric tubes in parallel flow and backflow conditions.

#### V. METHODOLOGY

The course is developed in a session of introduction and formation of groups, two sessions of basic theory, eight sessions of laboratory experiments, two sessions of oral support of the laboratory experiences taken before the week of partial exams and before the week Of final exams and two sessions of written control taken before the week of partial exams and before the week of final exams.

#### VI. EVALUATION FORMULA

Evaluation System "D". Calculation of Final

Average:  $PF = (8 \text{ EXP} + 2 \text{ CE}) / 10$ :

Laboratory experience

EXP: CE written control.

#### VII. BIBLIOGRAPHY

1. ASTM Standards.

2. Manual of the Mechanical Engineer. Volume I, II, III.

3. Manual of the Mechanical Engineering Laboratory FIM I, II, III.

\* Include preferably two texts (no more than three) and, where possible, world reference books.