



**NATIONAL UNIVERSITY OF ENGINEERING**  
**COLLEGE OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**ELECTRICAL ENGINEERING PROGRAM**

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**EM221 – TURBOMACHINES**

**I. GENERAL INFORMATION**

<b>CODE</b>	: EM221 – Turbomachines
<b>SEMESTER</b>	: 8
<b>CREDITS</b>	: 02
<b>HOURS PER WEEK</b>	: 03 (Theory – Practice)
<b>PREREQUISITES</b>	: HH221 – Fluid Dynamics
<b>CONDITION</b>	: Mandatory

**II. COURSE DESCRIPTION**

It is a subject of a theoretical – practical nature and belongs to the area of professional training. Its purpose is to train the student for the analysis, operation and selection of the driven turbomachines and driven turbomachines.

**III. COURSE OUTCOMES**

At the end of the course the student will:

- Identify, design and understand the functions of all the components of a turbomachine.
- Know the concepts necessary to calculate the parameters of the energy processes that happen in a turbomachine.
- Have the criteria to choose which equipment is necessary for different engineering purposes.

**IV. LEARNING UNITS**

**1. GENERAL CONCEPTS**

Conformation and elements of a turbomachine. Classification of turbomachines.

**2. PRINCIPLE OF OPERATION OF TURBOMACHINES**

General Basics Effective height.

**3. GEOMETRY OF THE FLOW**

Radial and axial warps.

**4. SPEED DIAGRAMS**

Basic Relationships Euler's equation.

**5. TURBOMACHINE FLOW EQUATION**

**6. STATIC HEIGHT AND REACTION DEGREE**

**7. FLOW IN ROTARY AND RADIAL PRAYERS**

Influence of the finite number of blades and the thickness of the blades.

#### **8. RADIAL PACKAGING FORM**

#### **9. AXIAL PACKAGING FLOW**

Introduction to the theory of ailerons.

#### **10. AXIAL PACKAGING FORM**

#### **11. LOSSES AND EFFICIENCIES**

Internal losses. External losses Energy balance. Efficiency.

#### **12. CAVITATION**

#### **13. CHARACTERISTIC LINES AND SELECTION**

Pumps and fans.

#### **14. HYDRAULIC TURBINES**

### **V. METHODOLOGY**

The course is developed in theory and practice sessions. In the theory sessions the teacher presents the concepts, principles for turbomachines analysis and their importance in engineering. In the practical sessions different turbomachines problems and their various application are presented and solved. In all classes the active participation of the student is promoted both in the analysis and in the solution of problems.

### **VI. EVALUATION FORMULA**

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

- Average of Practices (P) is equal to the Final Grade.

### **VII. BIBLIOGRAPHY**

- "Principles of Turbomachinery", Seppo A. Korpela. John Wiley & Sons, 2012.
- "Centrifugal Pumps", Johann Friedrich Gulich. Springer, 2014.
- "Turbines, Compressors and Fans", S. M. Yahya. McGraw-Hill Education, 2010.