NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF MECHANICAL ENGINEERING
MECHANICAL ENGINEERING PROGRAM

MC586 – DESIGN OF MACHINE ELEMENTS II

I. GENERAL INFORMATION

CODE	: MC586 Calculus of Machine Elements II
CYCLE	: 8
CREDITS	: 4
HOURS PER WEEK	: 6 (Theory - Practice)
PREREQUISITES	: Calculus of Machine Elements II
CONDITION	: Compulsory

II. COURSE INTRODUCTION

The course prepares the student in the application of the concepts, methods and technical standards for the design of the machine elements, under the concept that all designs should be practical and economical to compete with other products. Design concepts are presented and applied in the mechanical engineering career, that is to say objects of mechanical character. Problems of application in engineering are developed and use of specialized software.

III. COURSE OUTCOMES

The student:

1. Designs, calculate and analyze the most representative machine elements, such as threaded elements, welded joints, flexible transmissions, rigid transmissions, power transmission shafts, bearings, brakes and couplings.
2. Selects the machine elements such as belts, chains, couplings, bearings, etc.
3. Manages the tools of analysis and kinematic design, relative movement of rigid and dynamic bodies, forces and bending and torsional moments.
4. Analyzes, calculates and designs the mechanisms by means of the elaboration of scale prototypes.
5. Handles the structural analysis tools, kinematic and dynamic for the design of simple industrial mechanisms.
6. Proposes, elaborates, evaluates and implements engineering projects in the design of systems, equipment and devices for the industry.

IV. LEARNING UNITS

1. **Introduction / 2 hours**
   Safety factor, service factor, design effort, permissible stresses, codes and standards (ISO, ANSI, DIN ,ASME ,SAE ,AGMA ,AISC ,etc.), materials, structural profiles.

2. **Gears / 24 hours**
   Introduction. Gears. Types of Gears. Geometry. Design parameters. Procedures of fabrication. Surface Finishing. Materials of manufacture. LEWIS cylindrical gears. Calculation by the AGMA method. Cylindrical gears of helical teeth. Calculate by the AGMA method. Examples of application. Straight teeth conical springs. Calculation by AGMA method. Examples of application.

3. **Worm Drives- Cogwheel / 24 hours**
   Worm Drives. Cogwheel. Characteristics. Geometry. Loads. Materials of manufacture. Calculate by the AGMA method. Heat Considerations. Examples of application.

4. **Axis and cotter / 12 hours**
   Axis. Types of axis. Materials. Loads and stresses. Calculation by the ASME method. Check by deformation. Examples of application. Critical axis speed. Examples of application. Cotter.

5. **Bearings / 12 hours**
   Bearings. Introduction. Classification, specifications, selection of bearing type. Selection of bearing size. Static charging capacity. Duration. Selection method. Application problems.

6. **Brakes and croches / 14 hours**
   Brakes; Introduction, types, materials, loads, belt brakes. Application example.

V. METHODOLOGY

Exposition. Master class of teacher. The teacher explains the theoretical foundations of the topic to be discussed.

Didactic questioning with students. Questions are asked to the students so that the teacher evaluates the degree of understanding of the students.

Examples of practical applications. With which the teacher can clarify certain doubts that have remained after the explanation.

Analysis of the examples presented. The teacher will analyze the examples and encourage discussion about them.

Introduction of application problems. Problems arise with which the student can find ways to apply the theory exposed.

Solution of problems raised in group form under the supervision of the teacher. Groups of students are formed that discuss how to solve the problems raised.

Students' exposition, by groups, of the solutions found to the problems posed. The groups formed must expose to the rest of the class the solution to certain problems.

Group project for the design, manufacture and analysis of a prototype mechanism, for which students are divided into groups to develop it, these projects are considered as part of the evaluation of the course.

VI. EVALUATION FORMULA

Evaluation System: F
The grading system will be with the Evaluation System F. Partial Weight Exam 01: Final Exam Weight 02 and Average Practices Weight 01.
The course will have 04 graded practices of which a practice that corresponds to the lowest grade is eliminated. The average of qualified practices (PPC) is obtained as follows: $PPC = \frac{P1 + P2 + P3}{3}$ and a practical work (TP) that is not eliminated.

The final average of practices is (PFP) $PFP = \frac{3PPC + TP}{4}$

The final grade of the course is: $NF = \frac{EP + 2EF + PFP}{4}$

VII. BIBLIOGRAPHY

- ALVA DAVILA. Design of Machine Elements I and II. 3rd Edition 2014.
- SHIGLEY JOSEPH. Design in Mechanical Engineering. Ed.1993.
- JUVENALL RROBERT. Fundamentals of Design for Mechanical Engineering.Ed.1991.
- VALLANCE. Fundamentals for Mechanical Design. Ed.1993.
- DECKER KABUS. Machine Elements. ED.1980.
- MOTT ROBER. Design in Mechanical Engineering.4th Edicion.2006.