NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF CHEMICAL AND TEXTILE ENGINEERING
CHEMICAL ENGINEERING PROGRAM

EM711 – INTRODUCTION TO MECHANICAL DESIGN

I. GENERAL INFORMATION

CODE	**:**	EM711 Introduction to Mechanical Design
SEMESTER	**:**	2
CREDITS	**:**	3
HOURS PER WEEK	**:**	5 (Theory – Practice – Labs)
PREREQUISITES	**:**	AU511 Technical Drawing
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

This course trains students in the use of technical drawing knowledge applied to mechanical design with the support of computer-aided drawing. The learning of this course provides students with the enough knowledge to understand elements of fastening and transmission, surface quality, types of setup and coupling; this knowledge provides students with attitudes such as: create, design, innovate, automate and implement.

III. COURSE OUTCOMES

1. Understanding the use and applications of mechanical components commonly used in industrial machines.
2. Draw mechanical components using computer aided applications.
3. Use proper and standardized symbology for drawing mechanical components.
4. Present drawings ad planes using proper norms.
5. Integrate mechanical components to configure medium-complexity machines.

IV. LEARNING UNITS

1. SECTION AND SURFACE FINISH / 15 HOURS

Sections / Types of sections: total, stepped, half a section, revolution, aligning, displacement, partial / Surface finish / Signal representation of surface finish / Use alternatives of surface finish signals. Use of chats recommended by ISO standards / Application examples.

2. FASTENING ELEMENTS / 5 HOURS

Fastening elements / Main types of screw profiles and their names / Representation and names of screw, washer, tacks, bolts, tongues / Use of standardized material tables and screw profiles.

3. WELDING / 5 HOURS

Welding / Butt, lap and insert weld. Representation according to ISO standard /Application examples: welded joints and boilermaking.

4. SETTING AND TOLERANCE / 10 HOURS

Setting and tolerance / Coupling / Types of settings / Setting tolerances. Names of axes and holes / Maximum and minimum dimensions / Tolerance applications using ISO standardized setting tables in the manufacture process of industrial parts / Couplings: Slide coupling with necking and indifferent / Determination of the type of coupling making operations and using ISO standardized setting tables / Tolerance application in industrial parts assembly.

5. GEARS / 25 HOURS
Spur gears / Front view and cross section representation / Main dimension / Method for determining the profile of a straight tooth gear / Use of the Gantt chart / Determining the dimensions of a spur gear from its power, RPM, gear ratio / Theory of the rack / Bevel gear / Front and horizontal view representation / Main dimension in ISO standards / representation of a 2 bevel-gear train with perpendicular axes from its power, RPM and gear ratio / Endless screw / Its representation / Main dimensions / Importance of the helix angle / Use of ISO tables.

6. PIPING / 10 HOURS
Piping / Symbols for pipe installation / Symbol forms / Groups pf symbols / Isometric representation of a valve-pipe system and its main views / Use of color codes / Representation of valves and accessories / Fluid transport representation using valves and pipes.

VI. METHODOLOGY

This course is carried out in theory, practical and lab sessions. In practical and lab sessions, students participation is encouraged, applying techniques of group dynamics, seeking to focus their skills on the technological innovation. The work mentioned above id of medium complexity and based on industrial parts brought by students for lab and practical sessions, the measurement of these are made using vernier scale, first carrying out an freehand scheme and then represent it in A3 and A2 sheets. In lab sessions, Inventor Professional 2010 software is used, with which 3D assembled devices and every single of their 2D components are represented in every single sheet, always encouraging colored assembly and disassembly concepts with the technical specifications table making possible their construction.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

PF = 0.25 EP + 0.35 EF + 0.20 PPC + 0.20 PLB

EP: Mid-Term Exam EF: Final Exam
PPC: Quizzes average PLB: Lab average

VIII. BIBLIOGRAPHY

1. **MATA J, ÁLVAREZ C. AND VIDONDO**
   Techniques of graphic expression 1-2 Metal Branch (Spanish)
   Don Bosco Editorial (2005)

2. **CECIL JENSEN, JAY D. HELSEL, DENNIS R. SHORT**
   Engineering Drawing and Design (Spanish)
   Mc Graw Hill Editorial (2008)

3. **JOSÉ M. AURIA APILLUELO, PEDRO IBAÑEZ CARABANTES, PEDRO UBIETO URTUR**
   Industrial drawing – Sets and disassemblies (Spanish)
   Thomson Editorial (2004)