COURSE: MACHINES AND MECHANISMS

SUBJECT MATTER: Fundamentals of Mechanical Engineering
MODULE: Core Topics of Industrial Engineering
PROGRAM: Degree in Chemical Engineering

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GENERAL CHARACTERISTICS

Type: ☐ Basic Formation, ☑ Compulsory, ☐ Elective

☐ Final Degree Project, ☐ Internship

Duration: Semestral   **Semester**: 8th
Number of ECTS credits: 3
Language(s): English, Spanish, Catalan

DESCRIPTION

JUSTIFICATION

The study of machine theory is essential for engineers in general. Since the Industrial Revolution began to define the laws necessary to create mechanisms (synthesis) capable of helping the human being to perform the work that faces. Methodologies were also established to study the operation of the same (analysis) and thus be able to improve and optimize them.

The subject Machines and Mechanisms explains the laws to make the synthesis and the analysis of mechanisms. The rigid solid model is used to study the behavior of the elements that make up the mechanisms and machines. They study basic mechanisms (articulated quadrilateral), combinations between the elements and other specific mechanisms such as those of cams and gears.

From this generalization, the fundamental objectives of this subject are broken down below:

- To know the differences between machines and mechanisms and understand the laws that determine their operation.
- To learn to perform cinematic syntheses based on the analysis of kinematic chains and their degrees of freedom.
- To learn to calculate speeds at any point of the kinematic chain using the graphical method and the analytical method.
- To learn to calculate accelerations at any point in the kinematic chain using the graphical method and the analytical method.
- To learn to identify or obtain the instantaneous centers of rotation (CIR) of the kinematic chains, and their relationship with the speeds and accelerations of the mechanisms.
- To learn to calculate the force transmitted at any point in the kinematic chain using the graphical method and the analytical method.
- To know the operation of the cams and gears and learn to calculate their basic parameters.

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COMPETENCES

- To be able to understand and apply knowledge of Chemistry and Engineering for its application in the field of Chemical Engineering. (CB1, E2)
- Be able to identify, formulate and solve basic problems in Mathematics, Chemistry, Physics, Computer Science, Biology, Economics and Graphic Expression and problems in the fields of Chemical Engineering and Chemistry. (CB2, E7)
- Be able to analyze, integrate and interpret data and information from the field of Chemical Engineering. (CB3, E8)
- Be able to work in a team. (CB4, T1)
- Knowledge of the principles of machine and mechanism theory. (CRI7)

PREREQUISITES

According to the program planning and academic regulations.

CONTENTS

1. Introduction to the Theory of Machines and Mechanisms
2. Synthesis of Mechanisms
3. Analysis of Mechanisms
4. Mechanical transmissions
5. Mechanisms of cams and gears

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METHODOLOGY

LEARNING ACTIVITIES

Learning Activities	Hours	ECTS Credits	Competences
Lectures	22	0,8	CB1,E2, CB2, E7, CB3, E8, CB4, T1, CRI7
Case and Problem-Solving Sessions	22	0,8	CB1,E2, CB2, E7, CB3, E8, CB4, T1, CRI7
Seminars		-	-
Practical & Lab Work		-	-
Presentations		-	-
Personal study	32	1,0	CB1,E2, CB2, E7, CB3, E8, CRI7
Assessment Tasks (Exams, Continuous Assessment...)	6	0,2	CB1,E2, CB2, E7, CB3, E8, CRI7
TOTAL	**82**	**3,0**	

TEACHING METHODOLOGY

The didactic methodology used in the subject is based on theoretical classes and practical problem solving classes. The theoretical and problem solving classes are linked to dynamic explanatory classes (content presentation), dynamic demonstration (the professor solves a problem) and active dynamics (the student solves the problem). At the end of each class the student is presented with the problem to solve for a future class in a way that encourages work outside the classroom.

For the personal study the student mainly has a specific material and self-content of the course in electronic format in the Moodle teaching platform, as well as a list of basic bibliographical references.

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ASSESSMENT

ASSESSMENT METHODS

Assessment Methods	Weight	Competences
Final Exam	50%	CB1,E2, CB2, E7, CB3, E8, CRI7
Midterm Exam/s	-	-
Follow-up Activities	40%	CB1,E2, CB2, E7, CB3, E8, CRI7
Reports and Presentations	9%	CB1,E2, CB2, E7, CB3, E8, CB4, T1, CRI7
Lab or Field Work	-	
Projects	-	
Host Student Evaluation	-	
Participation	1%	CB4, T1, CRI7

LEARNING OUTCOMES

- The student must demonstrate the knowledge of the nomenclature and the structure of the mechanisms, as well as the laws to combine elements and form kinematic chains. (E2, E7, E8, T1, CRI7)
- The student must demonstrate the knowledge of solving problems of kinematic, kinetic and dynamic analysis of mechanisms. (E2, E7, E8, T1, CRI7)
- The student must demonstrate knowledge of the mechanical transmission of movement between motor sources and work organs. (E2, E7, E8, T1, CRI7)

QUALIFICATION

The evaluation of the course will consider all the activities detailed in the table of the evaluation methods with their corresponding weight. The attendance, realization and delivery of all the activities oriented to overcome the subject is mandatory. In the continuous evaluation (partial controls and evaluable exercises) a minimum grade of 5 out of 10 is required. Failing this, the conditions to take the final exam will not be given. In the final exam a minimum grade of 5 out of 10 is required. Otherwise, the overall grade of the subject will be the final exam grade.

Likewise, it is mandatory that the attendance exceeds 75% of the lecture time scheduled for the subject. Assistance less than that indicated, without just cause, implies the direct suspension of schooling.

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ASSESSMENT OF THE COMPETENCES

For the evaluation of the E2, E7, E8 and CRI7 competences, the weighted notes of the activities included in the evaluation methods (partial evaluations, non-classroom activities and final exam) will be used as indicators. Students must demonstrate their ability to understand and apply the basic technical knowledge learned, the ability to solve problems related to theoretical content, and the ability to develop an adequate methodology to address the typical problems of machines and mechanisms. All these competences will be evaluated through specific sections in all partial evaluations and in the final exam.

The T1 competition and also the CRI7 will be evaluated based on the performance of the joint work and participation in the classroom (classroom activities).

Each evaluative activity will have a maximum score of 10 points that will be divided into quantities that quantify the degree of acquisition of competences by the student.

BIBLIOGRAPHY

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- Shigley, J.; Uicker, J.J. "Teoría de Máquinas y Mecanismos". McGraw-Hill, 1998
- Cardona, S.; Clos, D. "Teoría de Máquinas". Edicions UPC, 2001
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DOCUMENT HISTORY

PREVIOUS REVISIONS
January, 2017. Dr. Giovanni Gómez Gras
January, 2016. Dr. Giovanni Gómez Gras
January, 2015. Dr. Guillermo Reyes Pozo
January, 2011. Dr. Guillermo Reyes Pozo

CURRENT REVISION
January, 2019. Dr. Giovanni Gómez Gras