Kinematics and Dynamics of Machines

Academic Year: (2023 / 2024) **Review date: 15/01/2024 13:20:20**

Department assigned to the subject: Mechanical Engineering Department

Coordinating teacher: RUBIO ALONSO, HIGINIO

Type: Electives ECTS Credits : 6.0

Year : 3 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Machine Mechanics
Engineering Graphics

LEARNING OUTCOMES

CB1. Students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study
CB2. Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.
CB3. Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements which include reflection on relevant social, scientific or ethical issues.
CB5. Students will have developed the learning skills necessary to undertake further study with a high degree of autonomy.
CG1. Ability to solve problems with initiative, decision-making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.
CG3. Ability to design a system, component or process in the field of Industrial Technologies to meet the required specifications
CG4. Knowledge and ability to apply current legislation as well as the specifications, regulations and mandatory standards in the field of Industrial Engineering.
CG5. Adequate knowledge of the concept of company, institutional and legal framework of the company. Organisation and management of companies.
CG6. Applied knowledge of company organisation.
CG8. Knowledge and ability to apply quality principles and methods.
CG9. Knowledge and ability to apply computational and experimental tools for the analysis and quantification of Industrial Engineering problems.
RA1. Knowledge and understanding: Have basic knowledge and understanding of science, mathematics and engineering within the industrial field, as well as knowledge and understanding of Mechanics, Solid and Structural Mechanics, Thermal Engineering, Fluid Mechanics, Production Systems, Electronics and Automation, Industrial Organisation and Electrical Engineering.
RA2. Engineering Analysis: To be able to identify engineering problems within the industrial field, recognise specifications, establish different resolution methods and select the most appropriate one for their solution
RA3. Engineering Design: To be able to design industrial products that comply with the required specifications, collaborating with professionals in related technologies within multidisciplinary teams.
RA5. Engineering Applications: To be able to apply their knowledge and understanding to solve problems and design devices or processes in the field of industrial engineering in accordance with criteria of cost, quality, safety, efficiency and respect for the environment.
RA6. Transversal Skills: To have the necessary skills for the practice of engineering in today's society.

OBJECTIVES

Kinematic and dynamic analysis of complex machines.
Predimensioning a machine according to the requirements and requests to which it will be subjected.

Analyze the behavior of the elements in rotation and/or translation.
Analyze the kinematic and dynamic behavior of complex machines.
Modeling and simulating a machine (modeling and computer simulation techniques).

DESCRIPTION OF CONTENTS: PROGRAMME

1.- Systematic study of the basic mechanisms. Types of friction. Analysis of lower-pair mechanisms. Bearings and others.
2.- Analysis and synthesis of cam machines.
3.- Study of geometry and analysis of gears. Spur gears.
4.- Gear trains and epicyclic gearsets.
5.- Study of geometry and analysis of gears.
5.2.- Helical gears.
5.2.- Bevel gears.
5.3.- Worm gears.
6.- Mechanical regulation. Flywheel design.
7.- Shocks and percussions in mechanical systems.
8.- Analytical mechanics applied to mechanisms.
9.- Special mechanisms and transmissions, flexible springs, leaf springs, belts, cables and chains...

LEARNING ACTIVITIES AND METHODOLOGY

Lectures, classroom exercises and laboratories (4).
Project: Make a computer application that calculates some mechanical element, written memory and presentation in class.
Project: Carry out a computer application on a mechanical element, written report and presentation to the class.
Other teaching materials: Recommended books, Selection of solved problems and Additional Notes.
Personalized tutorials: individual and in small groups.

ASSESSMENT SYSTEM

% end-of-term-examination/test:	50
% of continuous assessment (assigments, laboratory, practicals…):	50

1- Individually score the work done by the student during the course, with two partial exams (20%).
2- Performing a group project, on the mechanical system of the subject (20%).
3- Labs evaluation (10%).
4- In addition, if sections 1, 2 or 3 are not satisfactorily passed, there will be a final exam (50%).

ORDINARY CALL:
If the evaluation of sections 1, 2 and 3 is satisfactory, the student is approved and should NOT take the final exam and the final exam grade would be the average of the two partial exams.
The final exam will have two parts and, if the evaluation of any of the partial exams is passed, the student will partially release that part in the final exam.

EXTRAORDINARY CALL:
The final grade for students who attend the extraordinary call will be the highest grade between:
- 50% of the extraordinary exam and 50% of the continuous evaluation (sections 1, 2 and 3).
- 100% of the extraordinary exam.

BASIC BIBLIOGRAPHY

- J.C. García-Prada, C. Castejón, H. Rubio, J. Meneses Problemas Resueltos de Teoría de Máquinas y Mecanismos, Paraninfo, 2014

- J.E. Shigley, J.J. Uicker Teoría de máquinas y mecanismos, McGraw-Hill, 1998

ADDITIONAL BIBLIOGRAPHY

- Artés, M. Mecánica, Editado por la U.N.E.D., 2010

- Baránov, G.G. Curso de Teoría de Máquinas y Mecanismos, Editorial MIR, 1985

- Henriot, G. Manual práctico de engranajes, Marcombo, 1967

- Jaime Domínguez Abascal (coord.) Teoría de máquinas y mecanismos, Editorial Universidad de Sevilla, 2016

- Lamadrid, A. y Corral, A. Cinemática y dinámica de máquinas, Publicado por ETSII de la UPM, 1992

- Litvin, F.L. & Fuentes, A. Gear Geometry and Applied Theory, Cambridge Universitary Press, 2004

- Mabie, H.H. & Reinholtz, Ch.F. Mecanismos y dinámica de maquinaria, Limusa, 1998

- Moliner, P.R.; Martell,J. y Rodríguez, A. Elementos de Máquinas, Ed. U.N.E.D., 1976

- Niemann, G. Tratado teórico-práctico de Elementos de Máquinas, Ed. Labor, 1973

- Norton, R.L. Diseño de maquinaria, McGraw Hill, 2009

- Simón, A.; Bataller, A.; Guerra, A.J.; Ortiz, A. y Cabrera, J.A. Fundamentos de Teoría de Máquinas, Bellisco, 2000