

[GMF302] MECHANICAL DESIGN

GENERAL INFORMATION

Studies	DEGREE IN MECHANICAL ENGINEERING	Subject	?
Semester	1	Course	3
Character	COMPULSORY	Mention / Field of specialisation	
Plan	2022	Modality	Face-to-face
Credits	6	Language	CASTELLANO/EUSKARA
		Total hours	64 class hours + 86 non-class hours = 150 total hours

PROFESSORS

EZKURRA MAYOR, MIKEL
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REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
GRAPHIC EXPRESSION I	Mechanical Design
GRAPHIC EXPRESSION II	2D/3D design software (SolidWorks)
INTRODUCTION TO MECHANICAL DESIGN	

LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
GMR306 - To demonstrate ability to calculate, design and test machines		x		5,08
G-RTR1 - To develop interdisciplinary projects specific to their specialty and of gradual complexity, - becoming aware of respect for human rights and fundamental rights, and analyzing and assessing the impact of the proposed solutions on the SDGs - to acquire and/or apply basic, advanced and /or avant-garde, demonstrating the ability to work in multidisciplinary teams and/or undertake further studies with a high degree of autonomy		x		0,44
G-RTR2 - To express information, ideas and the arguments that support them in an orderly, clear and coherent manner, orally and in writing, based on quality information, self-made or obtained from different sources, using inclusive and non-discriminatory language		x		0,48
Total:				6

KC: Knowledge or Content / SK: Skills / AB: Abilities

ENAAE LEARNING RESULTS

- ENA102** - Knowledge and comprehension: Knowledge and comprehension of the engineering disciplines of their specialty, at the level necessary to acquire the rest of the competencies of the degree, including notions of the latest advances.
- ENA103** - Knowledge and comprehension: Awareness of the multidisciplinary context of engineering.
- ENA104** - Analysis in engineering: The ability to analyse complex products, processes and systems in their field of study; choose and apply relevant analytical, calculation and experimental methods in a suitable way; and correctly interpret the results of such analyses.
- ENA105** - Analysis in engineering: The ability to identify, formulate and solve engineering problems in their specialty; choose and apply adequately established analytical, calculation and experimental methods; and acknowledge the importance of social, health and safety, environmental, economic, and industrial restrictions.
- ENA106** - Engineering projects: Ability to project, design and develop complex products (parts, components, finished products, etc.), processes and systems of their specialty, which meet the established requirements, including awareness of the social, health and safety, environmental, economic and industrial aspects, as well as selecting and applying appropriate project methods.
- ENA107** - Engineering projects: Project capacity some state-of-the-art knowledge of their engineering specialty.
- ENA108** - Research and innovation: Ability to carry out bibliographic searches and consult and use databases and other information sources with discretion, in order to carry out simulation and analysis with the aim of conducting research on technical topics of their specialty.
- ENA109** - Research and innovation: Ability to consult and apply codes of good practice and security in their specialty.
- ENA110** - Research and innovation: Capacity and ability to project and carry out experimental investigations, interpret results, and reach conclusions in their field of study.
- ENA111** - Practical application of engineering: Understanding of the applicable techniques and methods for analysis, design and research and their limitations in the field of their specialty.
- ENA112** - Practical application of engineering: Practical competency to solve complex problems, carry out complex engineering projects, and conduct investigations specific to their specialty.
- ENA113** - Practical application of engineering: Knowledge of application of materials, equipment and tools, engineering technology and processes, and their limitations in the field of their specialty.
- ENA114** - Practical application of engineering: Ability to apply standards of engineering practice in their specialty.

ENA115 - Practical application of engineering: Knowledge of the social, health and safety, environmental, economic and industrial implications of engineering practice.

ENA118 - Preparation of judgements: Ability to manage complex technical or professional activities or projects of their speciality, taking responsibility for decision making.

ENA119 - Communication and Teamwork: Ability to effectively communicate information, ideas, problems and solutions in the field of engineering and with society in general.

ENA120 - Communication and Teamwork: Ability to operate effectively in domestic and international contexts, individually and as a team, and to cooperate with both engineers and people from other disciplines.

ENA121 - Continued training: Ability to acknowledge the need for their own continued training and to undertake this activity throughout their professional life independently.

ENA122 - Continued training: Ability to stay up to date on science and technology innovations.

SECONDARY LEARNING RESULTS

RGM390 [!] *Definir y gestionar los objetivos y la planificación de un proyecto que le permita adquirir y/o reforzar los conocimientos de tecnologías específicas de su especialidad,- que en ocasiones llegan a la vanguardia del conocimiento- y definir una estrate*

LEARNING ACTIVITIES

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

CH

1 h.

NCH

3 h.

TH

4 h.

EVALUATION SYSTEM

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

W

100%

MAKE-UP MECHANISMS

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

CH - Class hours: 1 h.

NCH - Non-class hours: 3 h.

TH - Total hours: 4 h.

RGM391 [!] *Coordinar el equipo de trabajo, estimulando la cohesión y buen clima para lograr la integración de todas las personas y su contribución para alcanzar un rendimiento apropiado, tanto a nivel individual como grupal, para el desarrollo del proyecto en*

LEARNING ACTIVITIES

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

CH

1 h.

NCH

3 h.

TH

4 h.

EVALUATION SYSTEM

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

W

100%

MAKE-UP MECHANISMS

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

CH - Class hours: 1 h.

NCH - Non-class hours: 3 h.

TH - Total hours: 4 h.

RGM392 [!] *Identificar y argumentar de forma precisa los ODS en los que incide el proyecto realizado, aportando posibles acciones para la mejora.*

LEARNING ACTIVITIES

Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams

CH

1 h.

NCH

2 h.

TH

3 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems

100%

(No mechanisms)

CH - Class hours: 1 h.

NCH - Non-class hours: 2 h.

TH - Total hours: 3 h.

RGM393 [!] *Elabora la memoria del proyecto, aportando argumentos elaborados y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

LEARNING ACTIVITIES

CH

NCH

TH

Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams

1 h.

5 h.

6 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

100%

(No mechanisms)

CH - Class hours: 1 h.

NCH - Non-class hours: 5 h.

TH - Total hours: 6 h.

RGM394 [!] *Realiza una presentación oral del proyecto, justificando las soluciones propuestas con argumentos elaborados y precisos, y haciendo un uso correcto, inclusivo y no discriminatorio del lenguaje.*

LEARNING ACTIVITIES

CH

NCH

TH

Development and writing of records, reports, presentations, audiovisual material, etc. on projects/work experience/challenges/case studies/experimental investigations carried out individually and/or in teams

1 h.

5 h.

6 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems

100%

(No mechanisms)

CH - Class hours: 1 h.

NCH - Non-class hours: 5 h.

TH - Total hours: 6 h.

RGM315 [!] *Diseñar conjuntos mecánicos, dimensionando elementos mecánicos, definiendo las tolerancias y los ajustes necesarios y elaborando documentación técnica sobre los resultados*

LEARNING ACTIVITIES

CH

NCH

TH

Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects

20 h.

6 h.

26 h.

Carrying out exercises and solving problems individually and/or in teams

14 h.

20 h.

34 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Individual written and/or oral tests or individual

100%

Individual written and/or oral tests or individual

coding/programming tests

coding/programming tests

CH - Class hours: 34 h.
NCH - Non-class hours: 26 h.
TH - Total hours: 60 h.

RGM316 [!] *Conocer y realizar ensayos de validación de máquinas*

LEARNING ACTIVITIES

	CH	NCH	TH
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints	2 h.	7 h.	9 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	3 h.		3 h.
Practical work in workshops and/or laboratories, individually and/or in teams	8 h.	4 h.	12 h.
Tutoring sessions and monitoring of training activities	2 h.	4 h.	6 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	35%
Individual written and/or oral tests or individual coding/programming tests	50%
Observation (technical capacity, attitude and participation)	15%

(No mechanisms)

CH - Class hours: 15 h.
NCH - Non-class hours: 15 h.
TH - Total hours: 30 h.

RGM317 [!] *Realiza los cálculos, diseño y los planos necesarios para la fabricación de una máquina a partir de unas especificaciones dadas.*

LEARNING ACTIVITIES

	CH	NCH	TH
Carrying out/resolving projects/challenges/cases, etc. to provide solutions to problems in interdisciplinary contexts, real and/or simulated, individually and/or in teams	10 h.	27 h.	37 h.

EVALUATION SYSTEM

W

MAKE-UP MECHANISMS

Presentation and defence of exercises, case studies, computer practical work, simulation practical work, laboratory practical work, term projects, end of degree project, master's thesis, challenges and problems	100%
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(No mechanisms)

Comments: Students have the responsibility of meeting the experts to do the tracking of the project and to ensure the achievement of the goals.

CH - Class hours: 10 h.
NCH - Non-class hours: 27 h.
TH - Total hours: 37 h.

CONTENTS

1. Kinematic chain modelling:

- Modelling principles
- Mechanical transmissions
- Steady-state vs. transient conditions

2. Dimensioning of machine elements:

- Rolling elements:

Rolling bearings

Ball screws

Guiding systems

- Belt transmission

LEARNING RESOURCES AND BIBLIOGRAPHY

Learning resources	Bibliography
Subject notes	MOTT, Robert L. Diseño de elementos de máquinas. Pearson Prentice Hall (2006)
Technical articles	DECKER, Karl-Heinz. Elementos de máquinas (Manual del Ingeniero Técnico, Volumen XIII) URMO
Class presentations	BUDYNAS, Richard. Diseño en ingeniería mecánica de Shigley. McGraw-Hill Interamericana de España S.L.; Edición: 8 (26 de febrero de 2008)
Video projections	NORTON, Robert L. Diseño de Máquinas. Norton, Robert L. (2010)
Student book	HARNOY Avraham. Bearing Design in Machinery. Engineering Tribology and Lubrication Marcel Dekker, Inc (2003)
Slides of the subject	BRANDLEIN, J. Ball and Roller Bearings Theory, Design, and Application. John Wiley Sons, Ltd. (1999)
	HARRIS, KOTZALAS. Advanced Concepts of bearing Technology. Taylor & Francis (2007)
	HUNG NGUYEN-SCHÄFER. Computational Design of Rolling Bearings. Springer (2016)
	ERWIN V. ZARETSKY. Rolling Bearing Life Prediction, Theory and Application. Glenn Research Center, Cleveland, Ohio (2013) https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20130011515.pdf
	HUGH SPIKES. Basic of EHL for practical application. Lubrication science 2015; 27:45-67
	CHILDS, Peter RN. Mechanical Design Engineering Handbook (2nd edition). Butterworth-Heinemann (2014)
	BUDYNAS, Richard G. eta all. Shigley's Mechanical Engineering Design (9th edition). Mc Graw Hill (2011)
	An Introduction to Stress Analysis and Transducer Design using Strain Gauges; 1987; Karl Hoffmann; Pfungstadt; ASIN: B001ALAP1WHBM; www.hbm.com
	Strain Gage Installations with M-Bond 200 Adhesive; Instruction Bulletin B-127-14; Micro-Measurements; www.micro-measurements.com
	Strain Gage Selection: Criteria, Procedures, Recommendations; Tech Note TN-505-4; Vishay Micro-measurements; www.vishaymg.com
	Vibration Transducers and Signal Conditioning; Brüel & Kjaer Sound and Vibration Measurement A/S; 1998; BA 7675-12; www.bksv.com
	Introduction to Shock and Vibration; Brüel & Kjaer Sound and Vibration Measurement A/S; 1998; BA 7674-12; www.bksv.com