

[GMF202] MECHANICAL DESIGN

GENERAL INFORMATION

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|------------------|----------------------------------|-------------------|-----------------|--|
| Studies | DEGREE IN MECHANICAL ENGINEERING | | Subject | ? |
| Semester | 1 | Course | 3 | Mention / Field of specialisation |
| Character | COMPULSORY | | Language | ENGLISH |
| Plan | 2017 | Modality | Face-to-face | Total hours |
| Credits | 6 | Hours/week | 3.72 | 67 class hours + 83 non-class hours = 150 total hours |

PROFESSORS

| |
|--------------------------|
| IRAGUI SAN PEDRO, MIKEL |
| LARRAÑAGA AMILIBIA, JON |
| LARRAÑAGA SERNA, MIREN |
| TENA MERINO, IOSU |
| AZKETA LASA, BEÑAT |
| ARAMENDI JAUREGUI, BEÑAT |

REQUIRED PREVIOUS KNOWLEDGE

| Subjects | Knowledge |
|-----------------------------------|--|
| INTRODUCTION TO MECHANICAL DESIGN | Mechanical Design 2D/3D design software |

SKILLS

VERIFICA SKILLS

SPECIFIC

GMCE02 - To have the knowledge and skills for calculating, designing and testing machines

GENERAL

GMCT01 - To be able to design, draft, sign and develop mechanical engineering projects for the construction, renovation, repair, maintenance, demolition, manufacture, installation, assembly and operation of structures, mechanical equipment, energy facilities, electric and electronic installations, industrial plants and facilities and manufacturing and automation processes.

GMCT02 - To be able to manage and coordinate tasks in mechanical engineering projects

GMCT03 - To build on basic concepts and technologies to expand knowledge of new theories and methods, and to acquire flexibility to adapt to new situations

GMCT04 - To be able to take the initiative in problem solving, decision making, creativity, critical thinking, effective communication and the transfer of knowledge and skills in the field of mechanical engineering.

GMCT06 - To be able to comply with specifications, regulations and standards

GMCT10 - To be able to do their job in multilingual, multidisciplinary environments

GMCT11 - Possessing the knowledge, understanding and ability to apply the legislation applicable to their work as an industrial engineering technician.

GMCT12 - To be able to do their job in cooperative, participatory environments, with awareness of social responsibility.

BASIC

G_CB1 - To have proven to understand and have knowledge in a field of study based on general secondary education at a level found in advanced textbooks and including concepts at the forefront of their field of study.

G_CB2 - To be able to apply knowledge to occupational or professional tasks; have the necessary skills to pose and defend arguments, and to solve problems within their field of study

G_CB3 - To be capable of gathering and interpreting relevant data (normally within their field of study) in order to make judgements, reflecting on relevant matters of a social, scientific or ethical nature

G_CB5 - To have developed learning abilities required to embark on subsequent studies with a high level of autonomy.

ENAAE LEARNING RESULTS

| ENAAE LEARNING RESULTS | ECTS |
|--|------|
| ENA102 - Knowledge and comprehension: Knowledge and comprehension of the engineering disciplines of their speciality, at the level necessary to acquire the rest of the competencies of the degree, including notions of the latest advances. | 5,28 |
| ENA103 - Knowledge and comprehension: Awareness of the multidisciplinary context of engineering. | 0,04 |
| 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. | 0,04 |
| ENA105 - Analysis in engineering: The ability to identify, formulate and solve engineering problems in their speciality; choose and apply adequately established analytical, calculation and experimental methods; and acknowledge the importance of social, health and safety, environmental, economic, and industrial restrictions. | 0,04 |
| ENA106 - Engineering projects: Ability to project, design and develop complex products (parts, components, finished products, etc.), processes and systems of their speciality, 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. | 0,04 |
| ENA107 - Engineering projects: Project capacity some state-of-the-art knowledge of their engineering speciality. | 0,04 |
| ENA108 - Research and innovation: Ability to carry out bibliographic searches and consult and use databases and other | 0,04 |

| | |
|--|----------|
| information sources with discretion, in order to carry out simulation and analysis with the aim of conducting research on technical topics of their speciality. | |
| ENA109 - Research and innovation: Ability to consult and apply codes of good practice and security in their speciality. | 0,04 |
| ENA110 - Research and innovation: Capacity and ability to project and carry out experimental investigations, interpret results, and reach conclusions in their field of study. | 0,04 |
| 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 speciality. | 0,04 |
| ENA112 - Practical application of engineering: Practical competency to solve complex problems, carry out complex engineering projects, and conduct investigations specific to their speciality. | 0,04 |
| 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 speciality. | 0,04 |
| ENA114 - Practical application of engineering: Ability to apply standards of engineering practice in their speciality. | 0,04 |
| ENA115 - Practical application of engineering: Knowledge of the social, health and safety, environmental, economic and industrial implications of engineering practice. | 0,04 |
| ENA118 - Preparation of judgements: Ability to manage complex technical or professional activities or projects of their speciality, taking responsibility for decision making. | 0,04 |
| ENA119 - Communication and Teamwork: Ability to effectively communicate information, ideas, problems and solutions in the field of engineering and with society in general. | 0,04 |
| 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. | 0,04 |
| ENA121 - Continued training: Ability to acknowledge the need for their own continued training and to undertake this activity throughout their professional life independently. | 0,04 |
| ENA122 - Continued training: Ability to stay up to date on science and technology innovations. | 0,04 |
| Total: | 6 |

LEARNING RESULTS

RG304 Define the problem, develop the solution and present the conclusions in a efficient manner, arguing and justifying each one of them in writing.

LEARNING ACTIVITIES

| | CH | NCH | TH |
|---|------|------|------|
| Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams | 2 h. | 4 h. | 6 h. |

EVALUATION SYSTEM

Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence

W

100%

MAKE-UP MECHANISMS

Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence
Comments: Continuous assesment and project feedback

CH - Class hours: 2 h.
NCH - Non-class hours: 4 h.
TH - Total hours: 6 h.

RG305 Define the problem, develop the solution and present the conclusions in a efficient manner, arguing and justifying each one of them in spoken form.

LEARNING ACTIVITIES

| | CH | NCH | TH |
|---|------|------|------|
| Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams | 2 h. | 4 h. | 6 h. |

EVALUATION SYSTEM

Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence

W

100%

MAKE-UP MECHANISMS

Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence
Comments: Continuous assesment and project feedback.

CH - Class hours: 2 h.
NCH - Non-class hours: 4 h.
TH - Total hours: 6 h.

RG302 Analyze the intervening variables in the problem and propose actions for a stable situation.

| LEARNING ACTIVITIES | CH | NCH | TH |
|---|----------|--|------|
| Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams | 2 h. | 4 h. | 6 h. |
| EVALUATION SYSTEM | W | MAKE-UP MECHANISMS | |
| Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence | 100% | Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence Comments: Continuous assesment and project feedback. | |
| CH - Class hours: 2 h. NCH - Non-class hours: 4 h. TH - Total hours: 6 h. | | | |

| RG316 Describe and carry out machine validation tests | | | |
|---|----------|--|-------|
| LEARNING ACTIVITIES | CH | NCH | TH |
| Individual study and work, tests and evaluations and check points | 2 h. | 7 h. | 9 h. |
| Presentation of the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 3 h. | | 3 h. |
| Individual or team workshop and/or lab practice | 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 | |
| Individual written and oral tests to assess technical skills of the subject | 50% | <i>(No mechanisms)</i> | |
| Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices | 35% | Comments: Feedback session before the defence | |
| Observation of student participation and attitude in the proposed training activities | 15% | | |
| Comments: The minimum mark to calculate the average is 5 both in the report and the individual test. | | | |
| CH - Class hours: 15 h. NCH - Non-class hours: 15 h. TH - Total hours: 30 h. | | | |

| RG301 Assumes responsibilities in the work team, organizing and planning the tasks to be developed, facing the contingencies and encouraging the participation of its members. | | | |
|---|----------|---|------|
| LEARNING ACTIVITIES | CH | NCH | TH |
| Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams | 2 h. | 3 h. | 5 h. |
| EVALUATION SYSTEM | W | MAKE-UP MECHANISMS | |
| Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence | 100% | Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence Comments: Continuous assesment and project feedback | |
| CH - Class hours: 2 h. NCH - Non-class hours: 3 h. TH - Total hours: 5 h. | | | |

| RG315 Design mechanical assemblies and size their mechanical elements, defining the necessary tolerances and fit, as well as developing technical documentation from the results | | | |
|---|-------|-------|-------|
| LEARNING ACTIVITIES | CH | NCH | TH |
| Presentation of the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects | 20 h. | 6 h. | 26 h. |
| Individual and team exercises | 14 h. | 20 h. | 34 h. |

| EVALUATION SYSTEM | W | MAKE-UP MECHANISMS |
|---|-----|---|
| Individual written and oral tests to assess technical skills of the subject | 50% | Individual written and oral tests to assess technical skills of the subject |
| Reports of solving exercises, case studies, computer practices, simulation practices and laboratory practices | 50% | |
| CH - Class hours: 34 h. | | |
| NCH - Non-class hours: 26 h. | | |
| TH - Total hours: 60 h. | | |

| RGM317 Perform the calculations, designs and drawings necessary to manufacture a machine from given specifications | | | |
|---|-------|--|-------|
| LEARNING ACTIVITIES | CH | NCH | TH |
| Development, writing and presentation of memorandums, reports, audiovisual material, etc. Relating to projects/POPBLs carried out individually or in teams | 10 h. | 27 h. | 37 h. |
| EVALUATION SYSTEM | W | MAKE-UP MECHANISMS | |
| Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence | 100% | Technical skills, involvement in the project, finished work, obtained results, handed documentation, presentation and technical defence Comments: Continuous assessment and project feedback | |
| CH - Class hours: 10 h. | | | |
| NCH - Non-class hours: 27 h. | | | |
| TH - Total hours: 37 h. | | | |

CONTENTS

1. Rolling Bearings

- Selection (type, size, characteristics...)
- Bearing arrangements
- Dimensioning and rating life
- Lubrication
- Software KissSoft. "Shaft calculation"

2. Machine testing

LEARNING RESOURCES AND BIBLIOGRAPHY

| Learning resources | Bibliography |
|---------------------|--|
| Subject notes | Notas técnicas: Micro Measurements TN-505-5, TN-504-1 y B-127-14 |
| Technical articles | Notas técnicas: National Instruments NI 3092, NI 4172 |
| Class presentations | Notas técnicas Brüel&Kjaer BA 7674-12, 7676-12 |
| Programmes | MOTT, Robert L. Diseño de elementos de máquinas. Pearson Prentice Hall (2006) |
| Video projections | DECKER, Karl-Heinz. Elementos de máquinas (Manual del Ingeniero Técnico, Volumen XIII) URMO |
| Student book | BUDYNAS, Richard. Diseño en ingeniería mecánica de Shigley. McGrawHill Interamericana de España S.L.; Edición: 8 (26 de febrero de 2008) |
| | NORTON, Robert L. Diseño de Máquinas. Norton, Robert L. (2010) |
| | HARNOY Avraham. Bearing Design in Machinery. Engineering Tribology and Lubrication Marcel Dekker, Inc (2003) |
| | 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

Strain Gage Installations with M-Bond 200 Adhesive; Instruction Bulletin B127-14; Micro-Measurements; www.micro-measurements.com