

## [MMC105] BIOMECHANICAL GENERATIVE DESIGN

### GENERAL INFORMATION

<b>Studies</b>	MASTER'S DEGREE IN BIOMEDICAL TECHNOLOGIES		<b>Subject</b>	?
<b>Semester</b>	2	<b>Course</b>	1	<b>Mention / Field of specialisation</b> ???
<b>Character</b>	OPTIONAL		<b>Language</b>	CASTELLANO
<b>Plan</b>	2023	<b>Modality</b>	Face-to-face	<b>Total hours</b> 33.8 class hours + 41.2 non-class hours = <b>75 total hours</b>
<b>Credits</b>	3	<b>Hours/week</b>	1.88	

### PROFESSORS

TORCA DE LA CONCEPCIÓN, IRENEO

### REQUIRED PREVIOUS KNOWLEDGE

Subjects	Knowledge
BIOMECHANICS BEHAVIOR AND DESIGN OF BIOMECHANICAL SYSTEMS	(No previous knowledge required)

### LEARNING RESULTS

LEARNING RESULTS	KC	SK	AB	ECTS
<b>MMR-26</b> - To apply the knowledge acquired and your problem-solving skills in new, little-known or changing environments within broader (or multidisciplinary) contexts related to your area of study		x		0,72
<b>MMR-28</b> - To communicate your conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences in a clear and unambiguous way		x		0,18
<b>MM14-2</b> - To apply mechanics concepts to the process of analysis, calculation and design of biomechanical and healthcare elements and assemblies using specific simulation tools		x		2,1
<b>Total:</b>				<b>3</b>

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

### SECONDARY LEARNING RESULTS

**RMM131** [!] *Calcular y diseñar conjuntos biomecánicos y sanitarios utilizando modelos estructurales de elementos finitos y de diseño generativo.*

#### 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		13,5 h.	13,5 h.
Personal study and flexible development of concepts and subjects using active dynamics, to foster more meaningful learning		2 h.	2 h.
Conducting tests, giving presentations, presenting defences, taking examinations and/or doing checkpoints		2 h.	2 h.
Computer simulation exercises, individually and/or in teams		15 h.	15 h.
Presentation by the teacher in the classroom, in participatory classes, of concepts and procedures associated with the subjects	20 h.		20 h.

#### EVALUATION SYSTEM

	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	75%
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	25%

**Comments:** If the score of the exam is lower than 4, this evaluation item will be evaluated in its entirety (%100) with the score of the exam.

#### MAKE-UP MECHANISMS

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

**CH - Class hours:** 20 h.

**NCH - Non-class hours:** 32,5 h.

**TH - Total hours:** 52,5 h.

**RMM147** [!] *Define los objetivos, realiza la planificación para su consecución y su seguimiento sistemático coordinando su trabajo con los demás miembros del equipo.*

**LEARNING ACTIVITIES**

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

CH

1,3 h.

NCH

,7 h.

TH

2 h.

**EVALUATION SYSTEM**

W

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

50%

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

**MAKE-UP MECHANISMS**

Observation (technical capacity, attitude and participation)

CH - Class hours: 1,3 h.

NCH - Non-class hours: ,7 h.

TH - Total hours: 2 h.

**RMM145** [!] *Conoce y es capaz de aplicar las herramientas de resolución de problemas en el campo de la Ingeniería Biomédica con iniciativa, toma de decisiones, creatividad y razonamiento crítico.*

**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

5,5 h.

NCH

3,5 h.

TH

9 h.

**EVALUATION SYSTEM**

W

Individual written and/or oral tests or individual coding/programming tests

40%

Co-assessment

5%

Prototype / Product

55%

**MAKE-UP MECHANISMS**

Observation (technical capacity, attitude and participation)

**Comments:** If the score of the defense is lower than 5, this evaluation item will be evaluated in its entirety (%100) with the score of the defense. A co-evaluation system will be implemented to adjust the score of the student based on his or her participation in the Project.

CH - Class hours: 5,5 h.

NCH - Non-class hours: 3,5 h.

TH - Total hours: 9 h.

**RMM144** [!] *Analiza las variables intervinientes en la solución de los problemas y plantea acciones para lograr una situación estable asumiendo responsabilidades en el equipo de trabajo, afrontando contingencias y organizando y planificando tareas.*

**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

5,5 h.

NCH

3,5 h.

TH

9 h.

**EVALUATION SYSTEM**

W

Individual written and/or oral tests or individual coding/programming tests

40%

Co-assessment

5%

Prototype / Product

55%

**MAKE-UP MECHANISMS**

Observation (technical capacity, attitude and participation)

**Comments:** If the score of the defense is lower than 5, this evaluation item will be evaluated in its entirety (%100) with the score of the defense. A co-evaluation system will be implemented to adjust the score of the student based on his or her participation in

the Project.

**CH - Class hours:** 5,5 h.

**NCH - Non-class hours:** 3,5 h.

**TH - Total hours:** 9 h.

**RMM146** [!] *Define el problema, el desarrollo de la solución, así como las conclusiones de manera eficaz, argumentando y justificando cada una de ellas, y haciendo un uso correcto del lenguaje, por escrito y de manera oral.*

#### 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	1,5 h.	1 h.	2,5 h.

#### EVALUATION SYSTEM

	W
Reports on the completion of exercises, case studies, computer exercises, simulation exercises, laboratory exercises, term projects, challenges and problems	50%
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	50%

#### MAKE-UP MECHANISMS

Observation (technical capacity, attitude and participation)

**CH - Class hours:** 1,5 h.

**NCH - Non-class hours:** 1 h.

**TH - Total hours:** 2,5 h.

## CONTENTS

1. ADVANCED STRUCTURAL DESIGNa. Advanced structural simulationb. Advanced dynamis simulationc. Topologico optimization and generative design

## LEARNING RESOURCES AND BIBLIOGRAPHY

### Learning resources

Specific Master Software  
Subject notes  
Technical articles  
Moodle Platform

### Bibliography

Fundamentals of Biomechanics: Equilibrium, Motion and Deformation, Nihat Özkaya, David Goldsheyder, Margareta Nordin. 4th edition, 2017, ISBN 978-3-319-44737-7, Springer  
Finite Element Analysis: From Biomedical Applications to Industrial Developments. Edited by David Moratal, 2016. ISBN-10: 953-51-0474-8; ISBN-13: 978-953-51-0474-2. Open Access distributed under the Creative Commons Attribution 3.0 license  
Mechanics of Materials, Roy R. Craig Jr., 3rd edition, 2011, ISBN 978-0-470-48181-3, John Wiley and Sons  
A Primer of Biomechanics, George L. Lucas, 1999. Springer Science+Business Media. Springer