Teaching Guide				
Identifying Data				2020/21
Subject (*)	Biomechanics		Code	730497227
Study programme	Mestrado Universitario en Enxeñaría Industrial (plan 2018)			
Descriptors				
Cycle	Period	Year	Type	Credits
Official Master's Degree	1st four-month period	Second	Optional	3
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e Industrial			
Coordinador	Lugris Armesto, Urbano	E-mail	urbano.lugris@udc.es	
Lecturers	Lugris Armesto, Urbano	E-mail	urbano.lugris@udc.es	
Web	moodle.udc.es			
General description	Conicimiento das técnicas computacionais para a análise do movemento humano: modelos biomecánicos, captura de movemento, ferramentas de análise, interpretación de resultados.			
Contingency plan	1. Modifications to the contents 2. Methodologies *Teaching methodologies that are maintained *Teaching methodologies that are modified 3. Mechanisms for personalized attention to students 4. Modifications in the evaluation *Evaluation observations: 5. Modifications to the bibliography or webgraphy			

Study programme competences	
Code	Study programme competences
A3	ETI3 - Ability to design and test machines.
B1	CB6 - Possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context.
B2	CB7 - That students know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of ??study.
B5	CB10 - That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.
B6	G1 - Have adequate knowledge of the scientific and technological aspects in Industrial Engineering.
B13	G8 - Apply the knowledge acquired and solve problems in new or unfamiliar environments within broader and multidisciplinary contexts.
B16	G11 - Possess the learning skills that allow to continue studying in a self-directed or autonomous way.
C1	ABET (a) - An ability to apply knowledge of mathematics, science, and engineering.
C2	ABET (b) - An ability to design and conduct experiments, as well as to analyze and interpret data.
C3	ABET (c) - An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
C8	ABET (h) - The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
C9	ABET (i) - A recognition of the need for, and an ability to engage in life-long learning.

C11	ABET (k) - An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Learning outcomes			
Learning outcomes	Study programme competences		
Estudo das características da marcha humana		BJ1 BJ6 BJ13 BJ16	CJ1 CJ8 CJ9 CJ11
Coñecemento e manexo dun laboratorio de análise de marcha		BJ1 BJ6 BJ13 BJ16	CJ1 CJ2 CJ3 CJ8 CJ9 CJ11
Modelización e análise dinámica do corpo humano como sistema de sólidos ríxidos	AJ3	BJ1 BJ2 BJ5 BJ6 BJ13 BJ16	CJ1 CJ2 CJ3 CJ8 CJ9 CJ11

Contents	
Topic	Sub-topic
Introdución á Biomecánica	Características e fases da marcha humana Modelos cinemáticos e dinámicos do corpo humano
Análise cinemática da marcha	Pares cinemáticos Cálculo de velocidades e aceleracións angulares
Sistemas de captura de movemento	Sistemas de captura óptica Placas de forza Outros sensores
Análise dinámica da marcha	Ecuacións da dinámica Parámetros dinámicos do sistema Dinámica inversa e directa
Análise de esforzos musculares	Problema da repartición muscular: optimización Modelo muscular de Hill

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A3 B1 B2 B5 B6 C1 C3 C8 C9 C11	6	0	6
Laboratory practice	A3 B1 B2 B13 B16 C2 C3 C8 C9 C11	6	0	6
ICT practicals	A3 B1 B2 B5 B13 B16 B6 C1 C2 C3 C8 C9 C11	6	9	15
Supervised projects	A3 B1 B2 B5 B13 B16 B6 C1 C2 C3 C8 C9 C11	10	36	46

Personalized attention		2	0	2
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Guest lecture / keynote speech	Explicación dos conceptos teóricos en clases interactivas
Laboratory practice	Realización de capturas de movemento na sala experimental
ICT practicals	Análise dos datos de captura
Supervised projects	Realización dunha análise de marcha completa, desde a captura aos esforzos musculares

Personalized attention	
Methodologies	**Description**
Supervised projects	Todas as prácticas serán realizadas baixo a tutela do profesor. Tamén se poderán resolver dúbidas durante o horario de tutorías. No caso de estudantes con dispensa académica, proporcionarase ao estudante material para que poida realizar a maioría das prácticas de forma non presencial, e o profesor atenderao durante as tutorías sempre que este solicíteo, ou noutro horario se non puidese acudir no horario de tutorías.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Laboratory practice	A3 B1 B2 B13 B16 C2 C3 C8 C9 C11	Valorarase a comprensión dos procesos implicados na captura de movemento	15
ICT practicals	A3 B1 B2 B5 B13 B16 B6 C1 C2 C3 C8 C9 C11	Os alumnos deberán comprender ben o procesamento dos datos de captura para obter esforzos articulares e musculares	25
Supervised projects	A3 B1 B2 B5 B13 B16 B6 C1 C2 C3 C8 C9 C11	Comprobarase que os alumnos sexan capaces de realizar unha análise de marcha completa, resolvendo os problemas técnicos que se poidan presentar	60

Assessment comments
No caso de estudantes con dispensa académica, a avaliación basearase nun seguimento do traballo realizado durante o curso, e no proxecto final que devanditos alumnos tamén terán que realizar.

Sources of information	
Basic	- Winter, D.A. (2009). Biomechanics and Motor Control of Human Movement. John Wiley & Sons - Levine, D., Richards, J., Whittle, M.W. (2012). Whittle's Gait Analysis. Churchill Livingstone
Complementary	- Beer, F.P. and Johnston, E.R. (2013). Mecánica vectorial para ingenieros: Estática McGrawara ingenieros: Estática. McGraw-Hill - Beer, F.P. and Johnston, E.R. (2013). Mecánica vectorial para ingenieros: Dinámica. McGraw-Hill - Goldstein, H. (2009). Mecánica clásica. Reverté

Recommendations
Subjects that it is recommended to have taken before
Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

Other comments
Para axudar a conseguir unha contorna inmediata sostida e cumprir co obxectivo da acción número 5: "Docencia e investigación saudable e sustentable ambiental e social" do "Plan de Acción Green Campus Ferrol": A entrega de traballos que se realicen nesta materia:- Solicitarase en formato virtual e/ou soporte informático.- Realizarase a través da web da materia, en formato dixital, sen necesidade de imprimilos.- En caso de ser necesario realizalos en papel: non se empregarán plásticos; realizaranse impresións a dobre cara; empregarase papel reciclado; evitarase a impresión de borradores.Débese facer un uso sustentable dos recursos e a prevención de impactos negativos sobre o medio natural.