

**Información del Plan Docente**

<b>Academic Year</b>	2017/18
<b>Faculty / School</b>	110 - Escuela de Ingeniería y Arquitectura
<b>Degree</b>	547 - Master's in Biomedical Engineering
<b>ECTS</b>	3.0
<b>Year</b>	1
<b>Semester</b>	Second semester
<b>Subject Type</b>	Optional
<b>Module</b>	---

**1.General information****1.1.Introduction****1.2.Recommendations to take this course****1.3.Context and importance of this course in the degree****1.4.Activities and key dates****2.Learning goals****2.1.Learning goals****2.2.Importance of learning goals****3.Aims of the course and competences****3.1.Aims of the course****3.2.Competences****4.Assessment (1st and 2nd call)****4.1.Assessment tasks (description of tasks, marking system and assessment criteria)****5.Methodology, learning tasks, syllabus and resources****5.1.Methodological overview**

The methodology followed in this course is oriented towards achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures where the main contents are presented and discussed; computer lab sessions, practical tasks based on real application, and specific research activities.

Students are expected to participate actively in the class throughout the semester.

## 5.2. Learning tasks

The course includes the following learning tasks:

- **A01 Lectures (22 hours).** The main course contents are presented and student participation is encouraged. There is audiovisual support to present practical cases and examples of specific hardware and software used in this field. The participation of a forensic doctor of the Institute of Legal Medicine of Aragon is scheduled to impart a master class about functional capacity evaluation and legal medical procedures.
- **A03 Computer Lab practices (4 hours).** Sessions will be conducted in small groups of 2 or 3 students with specific hardware and software of application in Ergonomics and Functional Capacity Evaluation assessments. They will use motion capture systems based on wireless or optical sensors which are available in the biomechanics laboratory of I3A and in the Area of engineering project of EINA. These resources can be used later for the students in the development of their assignments.
- **A05 Assignments.** In pairs or group of 3 students, they should elaborate two assignments, one on the field of ergonomics of work-product, and the other on the field of functional capacity assessment. To prepare these assignments students will use evaluation systems (software-hardware) employed in the practice sessions -they are available in laboratories and areas referred. Students will submit a written report of each case study, including a literature review, case description, methods and procedures used, analysis of results and final conclusions. These reports should be orally defended.
- **A06 Tutorials.** Office hours when students can review and discuss the topics presented in both theoretical and practical classes or solve doubts concerning the assignment.
- **A08 Assessment.** The student will take an exam and submit several reports derived from the computer sessions and the practical tasks.

## 5.3. Syllabus

The course will address the following topics:

1. **Ergonomic objects.** Ergonomics of work and product. Fields of application. Ergonomic methodology.
2. **Ergonomics, productivity and quality in the industry.**
3. **Musculoskeletal disorders (MSDs) of the workforce.** Movements and postures. Musculoskeletal system. Location of MSDs. Ergonomic intervention.
4. **Biomechanics and anthropometry.** Skeletal model. Anatomical drawings, reference systems of the body segments and joint movements. Biomechanical models of different percentiles of man and woman. Anthropomorphic models.
5. **Ergonomic analysis and evaluation** based on simulation and 3D digital models. Motion capture application in ergonomic analysis systems.
6. **Ergonomic analysis in product design.**
7. **Biomechanical analysis.** Reference systems of the body segments. Angles, displacements, velocities and linear and angular accelerations. Specific software.
8. **Postural load.** REBA Method (Rapid Entire Body Assessment). Risk levels and intervention. Using specific software.
9. **Lifting loads.** NIOSH equation. Single-tasking and multitasking. Using specific software.
10. **Evaluation of high-frequency repetitive upper limb movements.** UNE-ENE-1005-52007. MoveHuman-FORCES method (UZ).
11. **Functional Capacity Evaluation (FCE).** Object and field of application.
12. **Damage Valuation.** Medical-legal and forensic implications.
13. **Capacity assessment of the musculoskeletal system.** Methodologies, procedures and interpretation of results.
14. **Application of virtual reality systems** in the field of ergonomics and Functional Capacity Assessment.

## 5.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website.

**5.5. Bibliography and recommended resources**

- BB** Álvarez Casado, Enrique. Manual de evaluación de riesgos para la prevención de trastornos musculoesqueléticos / Alvarez, E.; Hernández, A.; Tello, S. Ed. Factors Humans, 2009
- BB** Chafin, B. Occupational Biomechanics / Chafin B, Anderson GBJ, Martin BJ . 3rd ed. New York: Wiley Interscience, 1999.
- BB** Colombini, Daniela. Risk Assessment and Management of Repetitive Movements and Exertions of Upper Limbs Job Analysis, Ocra Risk Indices, Prevention Strategies, and Design Principles / Colombini, D., Occhipinti, E. and Grieco A Amsterdam; Boston: Elsevier, 2002
- BB** Ergonomía : 20 preguntas básicas para aplicar la ergonomía en la empresa / [coordinadores], Javier Bascuas Hernández, José M. Álvarez Zárate . - 1ªed. Madrid : MAFRE, D.L. 2001
- BB** Guías para la evaluación de las deficiencias permanentes / American Medical Association . - 1a reimp. de la versión castellana Madrid : Ministerio de Trabajo y Asuntos Sociales, Instituto de Migraciones y Servicios Sociales, 1997
- BB** Huston, Ronald L . Principles of Biomechanics / Huston, Ronald L CRC Press Taylor & Francis Group, 2009
- BB** Marín Zurdo JJ, Boné Pina MJ, Martínez Jarreta MB. "Método MH-FORCES para valoración del riesgo de Trastornos Musculoesqueléticos derivados de movimientos repetitivos, comparación con método OCRA". En: Congreso Internacional de Prevención de Riesgos Laborales. ORP 2014. Zaragoza 05/2014.
- BB** Miralles Marrero, Rodrigo C.. Valoración del daño corporal en el aparato locomotor / Rodrigo C. Miralles Marrero Barcelona ; Madrid [etc.] : Masson, D.L. 2001
- BB** Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities. Panel on Musculoskeletal Disorder and the Workplace / National Research Council and Institute of Medicine. Washington, DC: National Academies Press. , 2001.

**LISTADO DE URLs:**

BERNARD, B. T. Musculoskeletal Disorders and Workplace Factors- Musculoskeletal Disorders and Workplace

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Factors: A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper-Extremity, and Low Back. . N° 97-141 ed., Cincinnati: NIOSH;US Department of Health and Human Services. , 1997

[<http://www.cdc.gov/niosh/docs/97-141/>]

Hignett, S and McATAMNEY, L. Rapid Entire Body Assessment: REBA Applied Ergonomics, 31, 201-5, 2000 (Sólo usuarios UNIZAR)

[<http://www.sciencedirect.com/science/article/pii/S0003687099000393>]

INSHT. El Transtorno Musculo-esquelético en el Ambito Laboral en Cifras. DE VICENTE, A., et al ed., Madrid: Departamento de Información e Investigación del Instituto Nacional de Seguridad e Higiene en el Trabajo. MEYSS, 2012.

[<http://www.oect.es/Observatorio/5%20Estudios%20tecnicos/Otros%20estudios%20de>

Marín Zurdo J. J., et al. Proceedings of the Sixth International Conference on Occupational Risk Prevention. Mondelo, P., et al ed., 2008. "Move-Human Sensors: Sistema Portátil de Captura de Movimiento Humano basado en Sensores Inerciales para el Análisis de Lesiones

Musculo-esqueléticas y utilizable en entornos reales". ISBN 84-934256-5-6.

[<http://www.prevencionintegral.com/en/canal-orp/papers/orp-2008/move-human-sensors>

Marín Zurdo, J. J.; Boné Pina, M.J, and Benito Gil, C. "Evaluación de Riesgos de Manipulación Repetitiva a Alta Frecuencia Basada en Análisis de Esfuerzos Dinámicos en las Articulaciones sobre Modelos Humanos Digitales". Ciencia & Trabajo, 2013, vol. 15, no. 47. pp. 86-93.

[<http://www.cienciaytrabajo.cl/cyt/Paginas/Evaluaci%C3%B3n-de-Riesgos-de-Manipulaci%C3%B3n-repetitiva-a-alta-frecuencia-basada-en-an%C3%A1lisis-de-esfuerzos-din%C3%A1micos-en-las-articulaciones-sobre-modelos-humanos-digitales>

NIOSH. National Occupational Research Agenda. Publication no. 96-115. . Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS ed., Cincinnati, OH: U.S.: , 1996.

[<https://www.cdc.gov/niosh/docs/96-115/>]

NIOSH. Research Topics for the Next Decade A Report by the NORA Musculoskeletal Disorders Team. . U.S. Department of Health and Human Services ed., DHHS (NIOSH) Publication No. 2001-117 ed. Cincinnati, Ohio: , 2001

[<https://www.cdc.gov/niosh/docs/2001-117/pdfs/2001-117.pdf>]

NTP 601 Evaluación de las condiciones de

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trabajo: carga postural. Método REBA (Rapid Entire Body Assessment). Instituto Nacional de Seguridad e Higiene en el Trabajo, España.

[<http://www.insht.es/InshtWeb/Contenidos/Documentacion/FichasTecnicas/NTP/F> OSHA-Europa. Factsheet 71: Introduction to Work - Related Musculoskeletal Disorders. , 2007.

[<https://osha.europa.eu/es/tools-and-publications/publications/factsheets/71>] UNE-EN 1005-3. Límites de fuerza recomendados para la utilización de máquinas. Julio 2009.

[<http://biblioteca.unizar.es/como-encontrar/normas-tecnicas>] UNE-EN 1005-4: 2008. Seguridad En Las Máquinas. Comportamiento Físico Del Ser Humano. Parte 4: Evaluación De Las Posturas Y Movimientos De Trabajo En Relación Con Las Máquinas.

[<http://biblioteca.unizar.es/como-encontrar/normas-tecnicas>] UNE-EN 1005-5: 2007. Seguridad En Las Máquinas. Comportamiento Físico Del Ser Humano. Parte 5: Evaluación Del Riesgo Por Manipulación Repetitiva De Alta Frecuencia.

[<http://biblioteca.unizar.es/como-encontrar/normas-tecnicas>] UNE-EN 547-3: 2008. Seguridad de máquinas. Medidas del cuerpo humano. Datos antropométricos.

[<http://biblioteca.unizar.es/como-encontrar/normas-tecnicas>]