

# Course guide 240EI012 - 240EI012 - Machine Technology

Last modified: 16/05/2023

Unit in charge: Teaching unit:	Barcelona School of Industrial Engineering 712 - EM - Department of Mechanical Engineering.		
Degree:	MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Compulsory subject).		
Academic year: 2023	ECTS Credits: 4.5	Languages: Catalan, Spanish	
LECTURER			

Coordinating lecturer:	Martinez Miralles, Jordi Ramon
Others:	Martínez Miralles, Jordi Ramon
	Veciana Fontanet, Joaquin Maria
	Domenèch Mestres, Carlos
	Blanco Romero, Maria Elena
	Caballero Flores, David
	De La Fuente Morató, Albert
	Fàbregas Massana, Xavier
	Perez Gracia, Maria Alba

### **PRIOR SKILLS**

Knowledge of Mechanics and Machine Theory. Knowledge of Strength of Materials and Materials Science. Group 30 of the autumn semester is taught in Spanish.

# **DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES**

#### Specific:

CEMEI03. Ability for the design and assays in machines.

#### **Generical:**

CGMEI02. (ENG) Projectar, calcular i disenyar productes, procesos, instal.lacions i plantes.

# **TEACHING METHODOLOGY**

The teaching methodology is based on two types of activities.

Class sessions in which the lecturer provides concepts and knowledge and, using practical exercises, shows how to apply them to solve real problems and situations. There is a 2 h class every week.

Practical sessions in small groups in which students carry out activities under the lecturer's supervision. There are lab sessions in which students become familiar with the various types of machine elements, and seminar sessions in which students solve exercises about dimensioning and selection of machine elements guided by the lecturer.

# LEARNING OBJECTIVES OF THE SUBJECT

General objective: To ensure that students acquire a thorough knowledge about the operation of the main commercial types of mechanical elements used in machines, and get the basic skills on how to select and size them.

Specific objectives: See the specific objectives of each part and each programmed activity



# **STUDY LOAD**

Туре	Hours	Percentage
Hours small group	13,5	12.00
Hours large group	27,0	24.00
Self study	72,0	64.00

### Total learning time: 112.5 h

### CONTENTS

### Mechanical fatige failure

### **Description:**

Fatige failure: the stress-life approach. Types of fatige loads. S-N diagram. Goodman's diagram. Correction factors.Notch sensitivity. Application to the calculus of rotating shafts.

### **Specific objectives:**

Knowledge of the basis of fatige failure. Abillity to identify the types of loads that cause fatigue failure. Being able to calculate rotating shafts under uniaxial stresses.

### **Related activities:**

Seminar sessions where the students carry out exercices under the lecturer supervision.

# Full-or-part-time: 26h

Theory classes: 6h Laboratory classes: 2h Self study : 18h

## Motors and receivers

### **Description:**

Analysis of the structure of a machine: motor-transmission-receiver. Proerties of motors and receivers. Obtaining the motion equation of a machine. Motors selection.

### **Specific objectives:**

Knowledge of the mechanical properties of motors and receivers. Knowing how to analyze the characteristic curve of a motor. being able to determine the motion equation of a machine. Ability to choose an electric motor for driving a steady operation machine.

#### **Related activities:**

Seminar sessions where the students carry out exercices under the lecturer supervision. Practical session devoted to the idetification of several types of motors and their properties.

**Full-or-part-time:** 22h Theory classes: 6h Laboratory classes: 2h Self study : 14h



### **Gear reducers**

### **Description:**

Function of gear reducers. Reducers and gear types. gear reducers failure. Lubrication. Selection criteria of gear reducers.

#### Specific objectives:

Knowledge of the main types of comercial gear reducers and their applications. Ability to choose a gear reducer as machine transmission, using the information provided by the manufacturer.

#### **Related activities:**

Seminar sessions where the students carry out exercices under the lecturer supervision. Practical session devoted to the idetification of several types of gear reducers and their properties.

### **Full-or-part-time:** 12h 30m Theory classes: 3h

Laboratory classes: 1h 30m Self study : 8h

### **Belt drives**

### **Description:**

Types of belt drives: frictional and timing belts. Kinematics and dynamics of belt drives. Dimensioning and selection of belt drives.

### Specific objectives:

Knowledge of the main types of belts: flat bets, V belts and timing belts. Knowing how to analyze the dynamic behaviour of belt drives and how to determine the minimum needed mounting force. Ability to select the belt type and size the belt for a certain transmission using the information provided by the manufacturer.

#### **Related activities:**

Seminar sessions where the students carry out exercices under the lecturer supervision. Practical session devoted to the idetification of several types of belts and their pulleys.

### Full-or-part-time: 22h

Theory classes: 6h Laboratory classes: 2h Self study : 14h

#### **Rolling and sliding bearings**

#### Description:

Types of sliding bearings and their applications. Types of rolling bearings and their applications. Rolling bearing Failure. Dimensioning and selection of rolling bearings. Bearing mounting details.

#### **Specific objectives:**

Knowledge of the properties of the main types of sliding and rolling bearings, as well as their applications. Ability to select the type of rolling bearings and size them for a certain application using the information provided by the manufacturer.

#### **Related activities:**

Seminar sessions where the students carry out exercices under the lecturer supervision. Practical session devoted to the idetification of several types of sliding and rolling bearings.

### Full-or-part-time: 26h

Theory classes: 6h Laboratory classes: 2h Self study : 18h



# **GRADING SYSTEM**

Assessment is based on two evaluation activities: a mid-term, partial test and a final exam. Both the partial test and the final exam assess the theoretical and practical aspects of the subject. Some parts of the final exam can be related to activities developed during lab sessions. The final exam is a review of the whole subject, therefore the exam assess all the contents and skills the subject deals with.

The algorithm for calculating the final mark is:  $Nfinal = Maximum[0,3\cdot NPP+0,7\cdot NEF; NEF]$ 

Where: NPP = partial test mark; NEF = final exam mark.

A special exam will be offered in July to those students that have not passed the subject. The mark obtained with this exam replaces the final exam mark.

### **EXAMINATION RULES.**

Personal notes and reference material can be used during the practical exercises in both the partial test and the final exam. No documentation may be consulted during the theoretical part.

### **BIBLIOGRAPHY**

#### **Basic:**

- Bigordà, J. ; Fenollosa, J. La fatiga dels elements mecànics [on line]. Ed. rev. Barcelona: Edicions UPC, 1993 [Consultation: 21/07/2014]. Available on: <u>https://upcommons.upc.edu/handle/2099.3/36329</u>. ISBN 8483010526.

#### **Complementary:**

- Decker, K. H. Elementos de máquinas. Bilbao: URMO S.A. Ediciones, 1980. ISBN 8431403403.

- Budynas, R.G. Diseño en ingeniería mecánica de Shigley [on line]. 11a. Ciudad de México: Mc. Graw Hill, 2021 [Consultation: 29/03/2023]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=5485

#### 813. ISBN 9781456287610.

- Avilés, Rafael. Análisis de fatiga en máquinas. Madrid: Thomson, 2005. ISBN 8497323440.

- Norton, R. L. Diseño de máquinas : Síntesis y análisis de máquinas y mecanismos [on line]. 5a. Mèxic: McGraw Hill, 2013 [Consultation: 19/10/2020]. Available on:

http://www.ingebook.com/ib/NPcd/IB\_BooksVis?cod\_primaria=1000187&codigo\_libro=5701. ISBN 9786071509352.

- Mott, R. L. Diseño de elementos de máquinas. 4a. Mèxic: Prentice Hall (Pearson), 2006. ISBN 9702608120.

- Niemann, G. Elementos de máquinas. Volumen I. 1a. Barcelona: Labor, 1987. ISBN 8433562916.

### **RESOURCES**

### Audiovisual material:

- Transparències de classe. Audiovisual material prepared by the teaching team. This material is accessible through the Atenea Campus.