



LEARNING GUIDE

ANALYSIS AND SYNTHESIS OF MECHANISMS

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1 Brief introduction.

This course deals with basic concepts and mean techniques for synthesis and analysis of mechanisms.

When students finished, they will be able to create and analyse a great number of types of mechanisms. Course is focused on mean properties of synthesis and analysis of mechanisms, without large and tedious calculations since computer programs are used. Applying synthesis techniques students will create an extensive range of mechanisms. Then analysis techniques will allow students to simulate and see the motion of mechanisms, (velocities, accelerations, forces, etc.), and also to verify that they are useful.

This course is oriented for all specialities in engineering. The level of concepts is adequate for all different specialities of engineering.

In addition of the technical knowledge, English is the official language of the course. It is managed and given by German and Spanish teachers: engineers and language teachers. So, the course is focused to European students.

Summarizing, this course allows students to improve their knowledge on synthesis and analysis of mechanisms by computer programs, and to improve their English knowledge.

2 Who is it directed to?

European students, technicians and engineers

3 Objectives

The objective of the course is to give an overview of the techniques used in mechanical engineering for the analysis and synthesis of mechanisms.

This general goal takes shape in the following educational objectives:

- a) Concepts commonly applied to the analysis and synthesis of mechanisms.
- b) Learning of the graphical and analytical techniques commonly used in the synthesis of mechanisms, oriented to its application by means of computer science programs.
- c) Practice implementation of the knowledge and techniques acquired, by means of practical exercises of application in the industry and mechanical engineering.
- d) Oral presentations of technical analysis of mechanisms.



4 Brief history.

Since some years ago, the Escuela Universitaria de Ingeniería Técnica Industrial, (EUITI), and the Fachhochschule Frankfurt am Main, (FFM), at the University of Applied Sciences, have a learning cooperation agreement within the Sócrates/Erasmus program. Along these years, different activities of student exchange and teaching staff mobility have been accomplished. They are fitted in the frame of Industrial Engineering studies, in the specialities of Chemistry, Electronics, Electricity and Mechanics.

On April 2000, Ms. Susanne Gittel, as the Erasmus Coordinator from FFM, and Prof. Dr. Christoph Wirth from Fachbereich Feinwerktechnik of FFM, visited the EUITI. That visit made clear the interest of both Institutions in increasing learning and cooperation activities, which was specified in the academic year 2001-2002 with short courses in English on analysis and synthesis of mechanisms, with staff exchange. The courses, updated and improved, were repeated during the academic year 2003-2004:

- a) Course “Synthesis of Mechanisms”, at the Fachhochschule Frankfurt am Main, by Prof. Dr. José A. Lozano, from the Department of Industrial Mechanics of E.U. de Ingeniería Técnica Industrial de Madrid, lasting eight hours.
- b) Course “Analysis of Mechanisms”, at the E.U. de Ingeniería Técnica Industrial de Madrid, by Prof. Dr. Christoph Wirth from the Fachbereich Feinwerktechnik of Fachhochschule Frankfurt am Main, lasting eight hours.

Both short courses have been arranged with the cooperation of mentioned professors. As a result some learning materials and didactic tools have been developed.

At present, the two courses have been joined in a new e-learning course “Analysis and Synthesis of Mechanisms” offered in English, for German students from the Fachhochschule Frankfurt am Main and the Spanish students from the E.U. de Ingeniería Técnica Industrial de Madrid. In a future, they might offered for other foreign students of the European Union and other countries.

5 ECTS form

Name	“Analysis and Synthesis of Mechanisms”
Subject code	
Level	Grade
Course	
Type	Free configuration
Semester	
Dates	
Theoretical hours/week	
Practical hours/week	
Global hours/week	
ECTS credits	3
Spanish credits	3

6 Teaching staff

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7 Contents

1. ANALYSIS OF MECHANISMS

- 1.1 Introduction
- 1.2 Four-bar linkages
(Degree of mechanism freedom, chain-mechanism-motor mechanism, coupler curves)
- 1.3 Multi-link mechanism
- 1.4 Velocity and acceleration
- 1.5. Decoding techniques for the comprehension and assimilation

2. SYNTHESIS OF MECHANISMS

- 2.1. Introduction. Structural synthesis.
- 2.2. Synthesis of functions.
- 2.3. Synthesis of trajectories.
- 2.4. Synthesis of positions.
- 2.5. Communicative strategies for the production and expression of technical discourse.

8 Teaching Methodology

Along the course different teaching methods will be used:

- a) Learning basic and technical concepts.
- b) Exercises using computer science programs of support. (It will be necessary to use some computer for the presentations and to solve the exercises).
- c) Practical works made by the students, individually or on groups.

Some educational techniques will be used:

- a) E-learning. Some theoretical texts and practical exercises will be available in the Internet.
- b) Videoconference and video streaming.
- c) Computer programs for analysis and synthesis of mechanisms.
- d) An intensive week in Frankfurt or Madrid, (if feasible).

9 Computer programme.

The Programme: SAM (Simulation and Analysis of Mechanisms) is used for the exercises.

You can download a DEMO-version by: www.artas.nl and find information by E-mail: info@artas.nl

You will find the DEMO-version on CD-ROM in Reference [G3].



University of Applied Sciences
FH Frankfurt am Main

Analysis and Synthesis of Mechanisms



Universidad Politécnica de Madrid
E.U. de Ingeniería Técnica Industrial

10 Assessment methodology

Continuous assessment, with practical exercises.

There will be a normal written examination once a year (not via Internet) at the UNIVERSIDAD POLITÉCNICA DE MADRID and at the FACHHOCHSCHULE FRANKFURT AM MAIN-UNIVERSITY OF APPLIED SCIENCES.

11 Official language

The language of the course is English.



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GERMAN

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- [S6] Russell, B. Ciencia, Filosofía y Política. Aguilar, Madrid. 1968.