

Academic Year: ( 2019 / 2020 )

Review date: 11-09-2019

Department assigned to the subject: Department of Mechanical Engineering

Coordinating teacher: DIAZ ALVAREZ, JOSE

Type: Compulsory ECTS Credits : 6.0

Year : 1 Semester : 1

**STUDENTS ARE EXPECTED TO HAVE COMPLETED**

Students are expected to have passed:

- Production and Manufacturing Systems
- Mechanical technology

**COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.**

- Students will develop skills and acquire the necessary knowledge for the correct definition and selection of the production systems and processes necessary to obtain especially critical components.
- Students will develop their communication skills to communicate the results and conclusions.
- They will increase their ability to analyze advanced problems related with new processes and production systems (analytically and numerically).
- They will improve their ability to lead, plan and supervise multidisciplinary teams.
- The student will receive the necessary knowledge to make optimal designs according to the process and the production system used for its manufacture.
- The student will have a global vision of the industrial transformation until the arrival of Industry 4.0.

**DESCRIPTION OF CONTENTS: PROGRAMME**

- 1/ Introduction to the machining processes (milling, drilling, turning. Interest of high speed machining (good and bad points).
- 2/ Introduction to the modelization of machining (analytical, numerical and phenomenological). Advantages and limitations of each one.
- 3/ Determination of the cutting forces (orthogonal and oblique cutting) and chip contact length on the tool rake face.
- 4/ Description of the Merchant model. Hypothesis, critics and how to ameliorate it.
- 5/ The importance to have a good description of the behavior of the material in the numerical and analytical codes. Determination of the levels of strain and strain rate in the primary shear zone.
- 6/ Ley of behavior. Presentation of some leys and methodology to determine the Johnson-Cook parameters.
- 7/ Effect of the material behavior on the cutting process. Diferencies between metals and composites machining.
- 8/ Termical problem in machining (induced damage, friction, wear, ...)
- 9/ Description of analytical model of Molinari (hypothesis and complete explanation of the equations).
- 10/ Fabrication in the motorsport industry
- 11/ Machining in mechanical industry
- 12/ No conventional machining.
- 13/ Cutting tools.

## LEARNING ACTIVITIES AND METHODOLOGY

- Magistral lecture
- Problems lecture
- Homework prepared by student groups

## ASSESSMENT SYSTEM

- Final Exam = 60 % (about all the knowledge given by the profesor on theory of machining, Merchand and Molinari analytical models)
- Group homework = 40 %

It is required that the grade of the exam is superior to 4/10 in order to pass

**% end-of-term-examination:** 60

**% of continuous assessment (assigments, laboratory, practicals...):** 40

## BASIC BIBLIOGRAPHY

- Amateau, M.F. Engineering Composite Materials, Engineering Mechanics, 2003
- Jamal Y. Sheikh-Ahmad. Machining of Polymer Composites, Springer, 2009
- Jones, R.M. Mechanics of Composite Materials, CRC Press, 1998
- Matthew J. Donachie. SUPERALLOYS: A Technical Guide, ASM International.
- Mazumdar, S.K. Composites Manufacturing: Materials, Product, and Process Engineering , CRC Press Book.
- Michael C.Y.Niu. Composite Airframe structures, Hong Kong Conmilit Press Ltd., 1992
- Steinar Westhrin Killi. Additive Manufacturing: Design, Methods, and Processes, CRC Press, 2017