Università degli Studi della Basilicata
Scuola di Ingegneria

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| COURSE: Advanced Manufacturing Systems | | | |
| ACADEMIC YEAR: 2017-2018 | | | |
| TYPE OF EDUCATIONAL ACTIVITY: Characterizing | | | |
| TEACHER: Sorgente Donato | | | |
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| phone: +39 971205114 | | mobile (optional): | |
| Language: Italian | | | |
| ECTS: 6 | n. of hours: 54<br>32 for lessons<br>22 for tutorials | Campus: Potenza<br>Dept./School: School of Engineering<br>Master Program: Mechanical Engineering | Semester: I |

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course is focused on non-conventional processes for the manufacturing of mechanical components with a high-technology content. The main aim is to give students the basic knowledge of most common non-conventional processes in terms of both theoretical and technical aspects.

On completion of the module students should be able to:

- Know the most common laser material processing technologies (welding, cutting and heat treatment)
- Know the processes based on water jet and abrasive water jet machining
- Know the main non-conventional sheet forming techniques
- Know the processes based on electro discharge machining
- Know main features of the additive manufacturing techniques
- Know the fundamentals on the numerical simulation of manufacturing processes

Students get to apply these fundamentals on specific fields to which each process is suitable basing on technical, cost and quality criteria. In the course students develop the following skills:

- Choose the most suitable process to manufacture a component with a high-technology content
- Design or choose the right tools and equipment for different manufacturing processes
- Choose the optimal process parameters to meet functional, cost and quality requirements of a product

PRE-REQUIREMENTS

Students should know the conventional manufacturing processes. They also should know the principal properties of metallic materials, their plastic behaviour and the fundamentals of heat transfer. This knowledge is fundamental to understand the physical phenomena that are involved in non-conventional manufacturing processes.

SYLLABUS

Section I. Laser material processing

1.1 Theory of optics and laser beam generation
1.2 Laser sources and laser-matter interaction
1.3 Welding, cutting and heat treatment
1.4 Fundamentals on innovative techniques in laser material processing

Section II. Water jet machining

2.1 Physics of water jet machining
2.2 Principal features of a water jet and of an abrasive water jet machining system
2.3 Process parameters and how they affect features of the work-piece

Section III. Non-conventional forming processes
3.1 Plastic behaviour of metals according to processing temperature
3.2 Forming limit curve and formability tests in cold and hot conditions
3.3 Tube and sheet hydroforming
3.4 Incremental forming
3.5 Superplastic forming
3.6 Fundamentals of others innovative forming techniques

Section IV. Electro Discharge Machining
4.1 Physics of the process
4.2 Main features of an electro discharge machining system (wire and die sinking)
4.3 Process parameters and their influence on the features of the final product

Section V. Additive Manufacturing
5.1 Fundamentals of three-dimensional modelling and layering (slicing)
5.2 Main features (geometrical and surface) of manufactured components
5.3 Classification of additive manufacturing techniques
5.4 Features of most common techniques and of applied materials

Section VI. Numerical simulation
6.1 Fundamentals on finite element numerical modelling
6.2 Numerical simulation of laser material processing
6.3 Numerical simulation of forming operations

TEACHING METHODS
The course consists both in theoretical lessons (32 hours) and in classroom tutorials (22 hours).

EVALUATION METHODS
The student is assigned to write a brief technical report on an individual project and attend an oral examination.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Main texts and additional resources

- Resources available at https://sites.google.com/site/tecnologiaunibas
- M. Monno, B. Previtali, M. Strano (2012). Tecnologia Meccanica - Le lavorazioni non convenzionali. Citta Studi

Optional and recommended readings

- S. Kalpakjian, S.R. Schmid, "Tecnologia Meccanica", Seconda edizione italiana, Pearson
- John F. Ready, D.F. Farson, T. Feeley (Eds.), LIA Handbook of Laser Materials Processing, Springer, ISBN 978-3-540-41770-5
- W. Steen, J. Mazumder, Laser Material Processing, Springer, ISBN 978-1-84996-062-5
- Werner S. Villa, "Stampa 3D professionale", Tecniche Nuove, ISBN 978-88-481-3034-9
- F. Giusti e M. Santochi, “Tecnologia Meccanica e Studi di Fabbricazione”, Casa Editrice Ambrosiana, Milano

INTERACTION WITH STUDENTS

At the beginning of the course, the teacher will describe the aims, the content and the assessment criteria. The teacher will make the resources at the website https://sites.google.com/site/tecnologiaunibas available to the students.

EXAMINATION SESSIONS (FORECAST)[1]

*05/02/2018, 21/02/2018, 04/04/2018, 09/05/2018, 29/06/2018, 13/07/2018, 19/09/2018, 14/11/2018, 12/12/2018*

SEMINARS BY EXTERNAL EXPERTS YES □ NO ×

FURTHER INFORMATION

[1] Subject to possible changes: check the web site of the Teacher or the Department/School for updates.