Manufacturing Processes 2

1. **Course number and name:** 020PF2ES4 Manufacturing Processes 2

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours per week

3. **Name(s) of instructor(s) or course coordinator(s):** Ali Harkous

4. **Instructional Materials:** PowerPoint slides; Videos; Lab experiments.

   Textbooks/References:
   - Fundamentals of Modern Manufacturing, 7th edition, M.P. Groover, Wiley, 2020.
   - Manufacturing Engineering and Technology, 8th edition in SI units, S. Kalpakjian, Pearson Education, 2020.
   - A Textbook of Manufacturing Technology (Manufacturing Processes), R.K. Rajput, Laxmi publications, 2007.
   - Manufacturing Technology (Vol 1 & 2), 3rd edition, P.N. Rao, McGraw-Hill Education, 2001.
   - DeGarmo's Materials and Processes in Manufacturing, 11th edition, J.T. Black, Wiley, 2012.

5. **Specific course information**
   a. **Catalog description:**
   This course covers the main manufacturing processes used in the industry for different types of materials (metal, glass, plastics, rubber, composites, ceramics). It explains the techniques applied during the preparation of a product, from the fabrication of the primary parts to the finishing of the final assembled product. In addition to the "material removal processes" explained in the "Manufacturing Processes 1" course, the covered topics include: solidification processes (casting, molding …), particulate processing, deformation of metals and plastics, and assembly operations (welding, overmolding, threading...) Also, the course describes some advanced processes and technologies such as waterjet cutting, laser cutting, layer-design, 3D printing and nanotechnologies.

   b. **Prerequisite:** Manufacturing Processes 1 (020PF1ES3)

   c. **Selected Elective** for ME students.

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
   - Associate the engineering principles with the different steps of manufacturing: processing, treatment, assembly and finishing operations.
   - Describe the solidification process for different types of materials (Metal, Glass, Plastics, Rubber, Composite materials, Ceramics …).
   - Recognize the different steps of particulate processing and the conditions in which this type of manufacturing is used.
   - Discuss the different deformation processes for metals and plastics.

- Determine the assembly operations and distinguish the permanent joining processes from the mechanical fastening.
- Discuss several special and advanced manufacturing operations.

b. PI addressed by the course:

PI	2.1	2.2	2.3	6.1	6.2	6.4
Covered	x	x	x	x	x	x
Assessed	x	x	x	x	x	x

7. Brief list of topics to be covered

Part I: Processing Operations

- **Chapter 1: Solidification processes:** Metal casting – Glass-working – Processing of plastics – Processing of rubber – Processing of composite materials. (5 Lectures).
- **Chapter 2: Particulate processing:** Powder metallurgy - Processing of ceramics. (1 Lecture).
- **Chapter 3: Deformation processes:** Metal forming process – Bulk deformation (Rolling; Forging; Extrusion) – Wire and bar drawing – Sheet-metal forming processes (Cutting operations; Bending operations; Drawing; Bending of tube Stock; Other Sheet-Metal forming operations) –- Thermoforming of plastic materials – Vacuum forming of plastic materials. (5 Lectures).

Part II: Assembly Operations

- **Chapter 4: Permanent joining processes:** Fundamentals of welding – Welding processes – Brazing, soldering – Fusion bonding of plastic materials – Adhesive bonding – Overmolding process. (4 Lectures).
- **Chapter 5: Mechanical assembly:** Threaded Fasteners – Rivets and Eyelets – Assembly Methods Based on Interference Fits – Other Mechanical Fastening Methods. (1 Lecture).

Part III: Special Operations

- **Chapter 6: Special and advanced processes:** 3D Printing – Layer-Design or "StratoConception" – Water-jet machining – Integrated circuits – Electronics assembly and packaging – Chemical machining – Laser-beam machining – Electron-beam machining – Abrasive-jet machining – Microfabrication technologies – Nanofabrication technologies. (4 Lectures).