









| GENERAL INFORMATION | | | | | | |
|--|------------------------------|---|--|----------------------------|-----|--|
| Course name SI2. Next-G | | | en Metal Forming: From Simulation to | | | |
| | Industrial A | pplications | | | | |
| Semester ² | Character | | Optional | Type of module Specialisat | ion | |
| ECTS 6 | | | Modality | Face-to-face | | |
| Higher Education Institution(s) | | | Mondragon Unibertsitatea | | | |
| Lecturer(s) | | | Joseba Mendiguren | | | |
| | | | Julen Aquirre | | | |
| LEARNING AND TEACHING | | | | | | |
| ESCO Occupation(s) | | Mar Cal | Manufacturing engineer Calculation engineer | | | |
| ESCO Skill & Competences | | Metal forming technologies | | | | |
| (*no ESCO) | | Forging processes | | | | |
| | | Select material to process | | | | |
| | | Create a product's virtual model | | | | |
| | | Sustainable manufacturing | | | | |
| | | | Good manufacturing practices | | | |
| Learning outcomes | | | 2, EA1, EP3, E | P4 | | |
| (Please refer to Appendix 4 for the interpretation of the acronym) | | | | | | |
| Teaching methods | | Lec | Lectures. | | | |
| | | Ser | Seminars. Tutorials | | | |
| | | Case Studies. | | | | |
| | | Simulation-Based Learning. | | | | |
| | | Collaborative and Problem-Based Learning (PBL). | | | | |
| Assessment methods | | Problem sets and exercises. | | | | |
| | | Lab experiments. | | | | |
| | | Simulations and modelling exercises. | | | | |
| | | | Oral presentation & defence. | | | |
| Previous requirements (if necessary) | | | | | | |
| Advanced Simulation & Modelling | | | | | | |
| Product Lifecycle Ma | Product Lifecycle Management | | | | | |
| Content index | | | | | | |
| 1. INTRODCUCTION TO Metal Forming: Market Overview and Global Impact | | | | | | |
| 1.1. Overview of Sheet Metal Forming | | | | | | |
| 1.3. Current Challenges in the Industry | | | | | | |
| 2. Material model definition for advanced modellisation on metal forming | | | | | | |
| 2.1. Fundamentals of Elasticity and Plasticity | | | | | | |
| 2.1.2. Yield criteria | | | | | | |
| 2.1.3. Plasticity models | | | | | | |
| 2.1.4. Kinematic hardening, isotropic hardening and mixed hardening | | | | | | |
| 2.2.1. Basic Tribology | | | | | | |
| 2.2.2. Advanced Tribology models based on pressure and sliding speed | | | | | | |
| 2.3. Effect of Strain Rate and Temperature | | | | | | |
| 3. Advanced Process Modelling | | | | | | |
| 3.1. Essentials of Applied Simulation (Industry expert) | | | | | | |
| 3.2. Sheet Metal Forming | | | | | | |
| 3.2.1. Sneet Metal forming basics (Seminar with industry expert and/or industry visit) | | | | | | |
| 3.2.3. Advanced simulation of Sheet metal forming | | | | | | |
| 3.2.4. Lab teac | hing of Sheet n | netal | forming (at M | GEP facilities) | | |
| 3.3.5. Team-Based Practical Project | | | | | | |









3.3. Simulation of Bulk Metal Forming

- 3.3.1. Bulk Metal forming basics (Seminar with industry expert and/or industry visit)
- 3.3.2. Basic Simulation of Bulk metal forming
- 3.3.3. Advanced simulation of Bulk metal forming
- 3.3.4. Lab teaching of Bulk Metal forming (at MGEP facilities)
- 3.3.5. Team-Based Practical Project
- 3.4. Tribology in Process Simulations
- 3.5. Cutting-Edge Innovations in Metal Forming Simulations

4. Smart Manufacturing and Control Systems

- 4.1. Advances in Monitoring and Control
- 4.2. Smart Innovations in Sheet Metal Forming
- 4.3. Smart Innovations in Bulk Metal Forming

SUPPORTING BIBLIOGRAPHIC REFERENCES

https://doi.org/10.1016/j.cirp.2014.05.005 https://doi.org/10.1007/s12289-010-0992-9 https://doi.org/10.1007/978-3-540-88113-1 https://doi.org/10.1007/978-3-662-04013-3 https://doi.org/10.1007/s11740-023-01190-x https://doi.org/10.3390/ma13173873 https://doi.org/10.1016/j.jmrt.2023.08.073 https://doi.org/10.3390/ma17051087

SOFTWARE

PAM-STAMP (ESI Group) FORGE (Transvalor)