Learning Module Outline

Short Description	
Description of the module	**Materials in 3D Printing for Aerospace Applications** This module focuses on the selection, characterization, and effective utilization of materials in 3D printing processes. It provides a comprehensive overview of the material technologies currently employed in additive manufacturing, with particular emphasis on materials used in aerospace applications. The module examines the major classes of materials used in additive manufacturing, including polymers, metals, ceramics, and hybrid materials, and discusses their processing characteristics, advantages, limitations, and application areas. A central theme of the module is the relationship between material structure, processing conditions, and resulting properties. The influence of additive manufacturing parameters on microstructural development and defect formation is discussed. In addition to established material systems, the module explores emerging trends in additive manufacturing materials and material development. These include metal matrix composites and ceramic matrix composites. Practical examples and aerospace studies are incorporated throughout the module to demonstrate how material selection and process optimization influence component performance, and manufacturability. By integrating material science principles with additive manufacturing technology, this module provides a thorough understanding of how materials are selected, processed, and engineered to meet the demanding requirements of modern aerospace systems. The detailed content and organization of the module are outlined below. 1. Polymeric Materials for 3D Printing 1.1. 3D Printing of Polymers 1.2. 3D Printing Technologies with Polymers in Engineering Applications 1.3. Limitations and Opportunities in 3D Printing of Polymers 2. Metallic Materials for 3D Printing 2.1. 3D Printing of Metals 2.2. Limitations and Opportunities in 3D Printing of Metals 3. Ceramic and Hybrid Materials for 3D Printing 3.1. 3D Printing of Ceramic and Hybrid Materials 4. 3D Printing Technologies in Aerospace Applications 5. Conclusions

Target Groups	
Targets	• Engineering students (Aerospace, Aeronautical, Materials and Mechanical Engineering) • Engineers and technical staff in aerospace and aeronautical industries

Funded by the European Union

Learning Objectives	
Learning Objectives for this module	Upon completion of this module, participants will be able to: • Identify the material requirements specific to aerospace components. • Explain current material technologies used in 3D printing. • Classify materials suitable for 3D printing based on their properties and applications. • Select appropriate 3D printing processes for aerospace-grade materials.

Learning Resources	
Resources	• Scientific articles • Industrial reports • Books • Thesis

Self-assessment and Learning Activities	
Self-assessment and Learning Activities	• Textbook • Lesson presentations • Lesson reviews • Quizzes

This document was prepared by the project team from Eskişehir Osmangazi University.

Funded by the European Union