

# MATERIALS ENGINEERING AND NANOTECHNOLOGY (LM76)

(Lecce - Università degli Studi)

## Teaching SUSTAINABLE MATERIALS FOR STRUCTURAL AND NON-STRUCTURAL APPLICATIONS

GenCod A007324

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**Teaching in italian** SUSTAINABLE MATERIALS FOR STRUCTURAL AND

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**SSD code** ING-IND/22

**Reference course** MATERIALS ENGINEERING AND

**Course type** Laurea Magistrale

**Credits** 6.0

**Teaching hours** Front activity hours: 54.0

**For enrolled in** 2023/2024

**Taught in** 2024/2025

**Course year** 2

**Language** ENGLISH

**Curriculum** Percorso comune

**Location** Lecce

**Semester** First Semester

**Exam type** Oral

**Assessment** Final grade

**Course timetable**  
<https://easyroom.unisalento.it/Orario>

### BRIEF COURSE DESCRIPTION

The course aims to provide students with comprehensive knowledge of sustainable materials for different, structural and non-structural, applications in various fields. Development, production techniques, characteristics and possible applications of sustainable materials (i.e. materials of natural origin (bio-based), materials obtained as by-products of other processes/productions and secondary raw materials, waste materials of different origin, etc.) will be described and discussed. Available legislation and standards regulating the use/reuse of these materials in a specific application will be presented. Case studies of frontier applications of sustainable materials employed in different structural and non-structural, applications will be illustrated. Seminars on specific topics held by international scientists are planned.

### REQUIREMENTS

Students must have an in-depth knowledge of the topics presented in the course "Science, Technology and Sustainability of Polymers".

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## COURSE AIMS

### **Knowledge and understanding.**

At the end of the course, students will have acquired in-depth knowledge relating to sustainable materials for different, structural and non-structural, applications in various fields, to understand in which cases a material can be considered “sustainable”, what are the typical characteristics of sustainable materials.

### **Applying knowledge and understanding.**

After the course the student should be able to:

- 1) classify the sustainability characteristics of a material;
- 2) state whether a material can truly be considered “sustainable”;
- 3) analyze the source of sustainable materials (that is, how they were generated or produced);
- 4) select possible (structural or non-structural) applications for a sustainable material, in relation to its properties, performance and overall costs;
- 5) evaluate whether newly produced sustainable materials comply with current legislation and standards.

### **Making judgments.**

At the end of the course, students will have acquired adequate skills to evaluate the suitability of a sustainable material for a specific application, taking into account both economic and environmental aspects, possibly using the tools offered by the “Life Cycle Assessment” technique.

**Communication.** The students must be able to communicate with a varied and composite audience, not culturally homogeneous, in a clear, logical and effective way and with the appropriate terms, using the methodological tools acquired and their scientific knowledge. The course promotes the development of the following skills of the student: ability to expose with the appropriate specialist vocabulary any topic related to sustainable materials; ability to discuss on issues related to their selection, production, use/reuse, application.

**Learning skills.** Students will have to acquire the critical ability to relate, with originality and autonomy, to the typical problems of sustainable materials, including their origin and production, their use in different applications. They should be able to develop and apply independently the knowledge and methods learnt with a view to possible continuation of studies at higher (doctoral) level or in the broader perspective of cultural and professional self-improvement of lifelong learning. Therefore, students should be able to switch to exhibition forms other than the source texts in order to memorize, summarize for themselves and for others, and disseminate scientific knowledge.

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## TEACHING METHODOLOGY

The course consists of theory lessons, exercises, seminars held by international scientists. The theory lessons, carried out by using slides of other didactic material made available to students before the lesson, are aimed at improving their knowledge and understanding on sustainable materials through the illustration of definitions, assumptions and models. A part of the lessons will be dedicated to the legislation and standards governing the use/reuse of these materials. Case studies of structural and non-structural applications in which new sustainable materials can be exploited will be presented. Students are invited to take part to the lesson with autonomy of judgment, by asking questions and presenting examples. The exercises in classroom are aimed at illustrating how to exploit a sustainable material, obtained for instance as waste or industrial by-product, in different applications in replacement of a traditional material. The previous analysis could be aided by LCA techniques and procedures. The seminars are aimed at giving an insight on some selected topics on issues related to innovative applications of sustainable materials in different fields.

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## ASSESSMENT TYPE

### **Final (oral) exam:**

The student is first asked to present and discuss a proposal for the exploitation of an unexplored sustainable material in a specific application in replacement of a traditional material, with the analysis of the different steps involved in its production, the expected obtained (economic, environmental) benefits, possible limits, compliance with available legislation and standards. Then, the student will be asked to discuss on some of the sustainable materials for different, structural and non-structural, applications introduced during the course, illustrating advantages and limits for their possible real application.

In the evaluation of the exam, the following elements will be taken into consideration: the logical route followed by the student in proposing a sustainable material for a specific application; the correctness of the procedure used to present the proposal; the adequacy of the proposed solution in relation to the competencies that the student is supposed to have acquired; the capacity to make connections among the different topics covered in the course; the use of an appropriate technical language.

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## ASSESSMENT SESSIONS

Students can apply for the exam on Web-VOL system.

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## OTHER USEFUL INFORMATION

Students can find information on the date and time of meeting with students on the website <https://elearning.unisalento.it/>. Students can also contact her by e-mail: [mariaenrica.frigione@unisalento.it](mailto:mariaenrica.frigione@unisalento.it).

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## FULL SYLLABUS

### Theory Lessons:

- 1) Introduction to sustainable materials: possible definitions, origin and production, characteristics, performances, durability; how to recognize if a material is sustainable.
- 2) Structural and non-structural applications, characteristics, uses, available legislation and standards.
- 3) Use of sustainable materials in structural applications. Case studies: constructions, geo-polymers, composites with natural fibers, others.
- 4) Use of sustainable materials in non-structural applications. Case studies: bio-based coatings, Phase Change Materials, others.

Exercitations: examples on how to exploit a sustainable material, obtained for instance as waste or industrial by-product, in different applications in replacement of a traditional material, possibly using the tools offered by the "Life Cycle Assessment" technique.

Seminars held by experts.

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## REFERENCE TEXT BOOKS

Slides and other didactic material provided by the teacher.