Core courses

Core Courses

Faculty of Science and Engineering

Biobased Materials

Full course description

Presently, a transition from fossil-based to a more sustainable and biobased society is taking place. This change is driven by the current trend of climate change and the predicted depletion of fossil reserves. The aim of the chemical industry is to not only replace currently made plastics and polymers with sustainable biobased alternatives, but also to produce new materials with additional useful characteristics from biological renewable sources. This requires a multidisciplinary approach in which production of biological resources, its processing and possible modification are first steps. New chemical technologies or biotechnologies may be required to obtain the right methods and synthesis routes to produce biobased materials and new materials that have novel functionalities.

This course aims to introduce the students into the biobased economy and the multidisciplinary way of thinking in value chains from biobased resources to biobased materials. The transition to a biobased economy not only requires the development of novel technology and policies, but also a completely different approach. When doing biology, chemistry, materials science or technology, a different way of thinking and attitude are required to make a full transition possible. The change in thinking starts with the people designing and making the biobased products and technologies for the biobased economy.
In advance of your upcoming career as a scientist and in the nearby future your master’s thesis, you will also learn to write, present and defend a research proposal.

Course objectives

This course introduces students into the multidisciplinary field of biobased materials. The course aims to make the students comprehend the importance of the transition from a fossil-based to a more sustainable biobased economy and society. The scientific, industrial and societal challenges associated with this transition will be a central theme in this course.

In this course, students will get acquainted with the different parts of the biobased value chain from resources to biobased materials and their applications. They will study, understand and apply knowledge of biobased resources, conversion of biomass, biobased products (biofuels and bioplastics), disposal of biobased products and sustainability impact of biobased products over their life cycle.

In addition, students will learn how to develop a successful research proposal. They will define and crystallize a research question based on its feasibility and scientific relevance and will prepare and structure arguments and plan different parts of the proposal, such as the research design and the methods for data acquisition and analysis, as well as the societal impact of the proposed research. They will learn how to walk through the writing process starting from draft to the final version, and, finally, how to present the proposal in an appealing way and to defend the proposal for a critical audience.

Recommended reading

We will make use of scientific articles, official reports of governmental organizations or committees involved in promoting/supporting biobased products, materials and economy. References to course materials are provided per task or tutorial. We will not use a textbook for this course.

Maastricht University students have off-campus (this means outside Maastricht) access to protected services and resources, like databases, e-journals and e-books of the UM Library. On Brightlands Chemelot Campus, you can use the Brightlands Guest Wi-Fi to get internet access. Different solutions are provided for remote access: Direct Library login, Library Access Browser Extension, Student Desktop Anywhere (SDA) and Virtual Private Network (VPN). All information is provided on the website: https://library.maastrichtuniversity.nl/services/remote-access/

Textbook as further reading material
"Introduction to Chemicals from Biomass" (2015) J. Clark and F. Deswarte (ed.) Wiley (UK).

BBM1001
Period 1
2 Sep 2024
25 Oct 2024
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- Y. van der Meer

Teaching methods:
Skills, Lecture(s), PBL, Research
Assessment methods:
Assignment, Presentation and paper, Written exam
Faculty of Science and Engineering

Process Technology

Full course description

What is Process Technology? What is the difference between a process at laboratory scale and a process at industrial scale? To answer these questions, we can consider a typical mixing process as an example. The mixing process in the lab at small scale (gram) is straightforward as we can use tools such as a magnet or spoon to mix two (bio)chemicals.

What about at the large scale (tonne)? We need special technology to mix two (bio)chemicals at large scale. This is also true for other operations.
We need a reactor for the reaction. We might need a distillation column for separation. We need a heat exchanger for heating and cooling. We need a pump and a compressor for pressurisation and transfer liquids and gases. The reactor and all these unit operations together form a process, showing the importance of proven technologies when we study a process at the large scale.

The main aim of this course is to study the principles of the design of a reactor and the most important individual unit operations related to biobased process technologies. In this context, we need to study the interaction between the individual process elements. How does a high efficient unit operation affect the other unit operation? Is there any domino effect? Does a high efficient reactor help the unit operations? To answer these questions, we need to look at the process as a whole. In this context, mathematical models and process simulators play an important role to predict the phenomena in bioreactor, unit operations, and the whole process.

Course objectives

The aim of this course is to learn all the basic concepts associated with the proven technologies to process biomass into valuable products. This course presents not only reactors and main unit operations, but also the basic rules for designing the whole process. This is supported by the presentation and use of a process simulator and the relevant mathematical concepts.

Intended learning outcomes (ILOs)

At the end of this course, the students will be able to:

1. Illustrate how reactor and unit operations work.
2. Develop mathematical models for reactor and unit operations.
3. Solve mathematical equations related to the modelling of reactor and unit operations.
4. Analyse individual reactor and unit operations as well as the entire bioprocess using process simulator.
5. Evaluate past and present perspectives of the technologies and outline a future perspective of the technologies related to biobased products.
6. Present outcomes of scientific works to the audience composed of specialists and non-specialists.

Recommended reading

A set of specific references will be provided per each problem presented in tutorial meetings. Besides, the following general references are recommended to be considered prior to any other sources:

Textbook

A. B. de Haan (2015), Process Technology: An Introduction, De Gruyter, ISBN:

Biobased Materials

9783110336719. E-book available at the University Library

Process Simulator
COCO (CAPE-OPEN to CAPE-OPEN) Simulator (https://www.cocosimulator.org/)

Mathematics
https://www.wolframalpha.com/examples/mathematics/

Journals

- Bioresource Technology
- Biofuels, Bioproducts and Biorefining
- Separation and Purification Technology

BBM1005
Period 1
2 Sep 2024
25 Oct 2024
Print course description
ECTS credits:
6.0
Coordinator:

- A. Ghannadzadeh

Assessment methods:
Final paper, Assignment, Presentation, Written exam
Faculty of Science and Engineering

Molecular Biology and Physiology of Plants and Microbes

Full course description

This mandatory course aims to introduce students with limited biological background into the biology of plants and microbes. A deepened understanding of the molecular mechanisms underlying the growth, metabolism and reproduction of plants and microbes is the main aim of this course.

Most biobased materials are of plant origin, and therefore students should expand their knowledge of plants and plant products. The molecular biology of microbes will concentrate on the basic principles underlying their growth and manipulation for industrial-relevant processes. In addition to studying the metabolic routes leading to natural materials, the possibility of exploiting genetically modified organisms for biobased materials or building blocks production will also be introduced.

Course objectives

This course combines molecular biology and physiology of plants and microbes. It aims at making students aware of the functioning and differences in their structure, growth and reproduction, and their implication in the formation and production of biobased materials.

At the end of the course students can:
1) Describe the structure and organization of bacterial, yeast and plant cells; identify the main subcellular components of each cell type and explain their function.
2) Illustrate and compare the basic gene structure, organization and expression in plants and microbes, describe the main differences and explain how they influence their practical use for the production of biobased materials.
3) Explain the concepts of growth for unicellular and multicellular organisms, illustrate how these can be influenced and manipulated and predict the outcome of such manipulation.
4) Transfer the knowledge acquired during the lectures to new biobased materialsrelated topics and propose alternative ways to improve the production process or the material itself.
5) Perform a molecular biology experiment following a protocol, describe the principles behind the techniques used and propose adaptations of the experimental procedures in case of unexpected events.
6) Critically analyse scientific publications, extract the relevant information and communicate it in a clear and concise way.

Recommended reading

There are several text books that could be useful for this course. However, these books are often very specific and detailed, and do not cover all the topics of the course and/or contain a large amount of information we will not be able to cover in this course. Additionally, in this course we will make use of review and research articles. The lectures and your notes are the most valuable resources for information. Finally, searching for academic publications (e.g. via Pubmed at https://www.ncbi.nlm.nih.gov/pubmed/) will be required to obtain all the necessary information for the tutorial tasks.

Suggested literature:
- Campbell Biology. Ninth edition. ISBN 10: 0321558235; ISBN 13: 9780321558237
- Molecular biology of the cell. Bruce Alberts and Alexander D. Johnson. ISBN-13: 978-0815344322
- Plant physiology. Lincoln Taiz, Eduardo Zeiger. ISBN-13: 978-0878938667
- Microbiology: An Introduction, Gerard J Tortora, Berdell R Funke, Christine L Case. ISBN-13: 978-1292099149

Specific literature for specific assignments will be provided by the coordinator during the course.

BBM1002
Period 2

Biobased Materials

28 Oct 2024
20 Dec 2024
[Print course description]
ECTS credits:
6.0
Coordinator:

- [L. Bortesi]

Teaching methods:
Lecture(s), Skills, PBL, Research
Assessment methods:
Final paper, Presentation, Written exam
Faculty of Science and Engineering

Principles of Materials Science

Full course description

Polymeric materials are unique construction materials. Due to their low specific density and relatively mild processing/shaping conditions, which ultimately originate from their macromolecular nature, distinguish from conventional construction materials such as metals and ceramics. However, the long nature of the molecules entails very specific physiochemical behaviour that needs to be understood during birth of the molecules (polymerization), processing, and performance.

Polymeric materials are praised for their versatility in for example combining various mechanical properties combined with being lightweight. In order to develop new polymer materials, for example of biobased origin, and to mechanically position them in the strength vs stiffness, one needs to understand and apply the design loop in which polymer chemistry, physics, processing and performance are interlinked. The common denominator in creation and application of this understanding is a profound molecular and thermodynamic understanding.

Course objectives

The overall learning goal is to bridge the interconnectivity of the subdisciplines of polymeric materials science, being (i) polymer chemistry, (ii) physics, (iii) properties and (iv) performance, from (sub)nanometer to macroscopic length-scales using a molecular generic understanding. Consequently, seven Intended Learning Outcomes (ILOs) are defined:

1. Create a molecular understanding of (sub) nanometer and macroscopic polymer structures, architectures and assembly.
2. Explain the fundamentals of step and chain growth polymerization
3. Explain thermodynamics and kinetics of phase transitions for glassy and semi-crystalline polymers
4. Explain a molecular and theoretical understanding of polymer dynamics; rubber-elasticity and

visco-elasticity
5. Apply the effect of variations in (thermo)mechanical behaviour of polymer systems from a theoretical and practical perspective on performance; brittle, tough, plasticity, elasticity,…

Develop the underpinning research skills to pursue scientific research;

6. Create detailed insight in and hands-on experience with combining complementary polymer characterization and analysis techniques to answer your research questions.

7. Process, report, and assess your experimental findings – e.g. reflect to your observations and peer-reviewed articles (incl. adequate citing).

Recommended reading

Mandatory Literature
Books:

- Robert J. Young and Peter A, Lovell, Introduction to Polymers, 3rd edition, 2011, ISBN: 978-0-8493-3929-5.
- Leon E. Govaert, A.K. Van der Vegt, Martin van Drongelen, Polymers: from structure to properties, Delft University Press, 2020, ISBN: 97890-6562-4444.

Additional Literature
Reader chapters:

- Single chain conformations
- The glassy state and the glass transition
- Crystallization of polymers
- Rubber elasticity

Peer-reviewed publications:

- Meijer, H.E.H.; Govaert, L.E. Mechanical performance of polymer systems: The relation between structure and properties. Prog. Polym. Sci. 30 (2005), 915-938

BBM1003
Period 2
28 Oct 2024
20 Dec 2024
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- J.A.W. Harings

Teaching methods:
Lecture(s), Skills, Work in subgroups, PBL, Research
Assessment methods:
Final paper, Presentation, Written exam, Assignment
Faculty of Science and Engineering

Bio-Organic Chemistry

Full course description

Fundamental knowledge of reaction mechanisms and general organic chemistry concepts are the basis of understanding biology at the molecular level. This also provides tools to make completely novel molecules with designed and desired properties for applications in Medicines, Materials and Catalysis. Natural products and Biobased building blocks attract growing attention as crucial resources for the transition from crude-oil based chemical manufacturing towards a more sustainable biobased industry. In this course you will get familiar with fundamental organic chemistry principles and apply them in a number of organic reactions for the synthesis of more complex molecules. These principles will be highlighted with examples from Nature and Biology and applications in the synthesis and production of biobased materials will be discussed.

Course objectives

After the completion of this course you must, in the context of the discussed theory, be able to (ILOs):
1. Understand and apply fundamental Organic Chemistry concepts in the context of Biology and Biobased materials.
2. Predict how a functional group, or a combination of functional groups, reacts under defined reaction conditions and explain or predict chemo-, regio- and stereoselectivity where applicable.
3. Describe reactions and reaction types by means of a reaction mechanism.
4. Plan a short synthesis towards more complex (bio)organic molecules in the context of biobased materials
5. Synthesize simple (bio)organic molecules using basic organic synthesis techniques.
6. Purify and characterize the products from the organic syntheses performed.
7. Communicate by oral- and written presentation of experimental results and discussion outcomes.

Recommended reading

Mandatory Literature:
- We use the following textbook:
"Organic Chemistry", Clayden, Greeves and Warren 2nd Edition, 2012, ISBN: 978-0199270293 (Oxford University Press)

Additional Literature:
- Problem sets (PBL) and experimental procedures (RBL) will be provided by the tutorial staff.
- Suggested experimental book:
"Multiscale Operational Organic Chemistry- A Problem-Solving Approach to the Laboratory Course", John W. Lehman 2nd Edition, 2009
ISBN: 978-013241375-6 (Pearson Prentice Hall)
We highly recommend (not obligatory) a molecular model set for Organic Chemistry (You are allowed to use this during the exams):
see: https://www.bol.com/nl/p/molecular-model-set-for-organic-chemistry/1001004002880141/

Biobased Materials

BBM1010
Period 2
28 Oct 2024
20 Dec 2024
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- R.V.A. Orrù

Teaching methods:
Lecture(s), PBL, Research, Skills
Assessment methods:
Final paper, Written exam
Elective courses

Elective Courses

Faculty of Science and Engineering

Molecular Genetics and Bio-Engineering

Full course description

In a number of cases the desired biobased building blocks and/or biobased materials can be directly isolated from plants and microbes or be obtained by chemical modification of such building blocks or materials. However, an alternative is to genetically modify plants or microbes in such a way that they produce a novel molecule that can be used for
synthesis of biobased materials with different properties. This elective course aims at providing a deeper understanding of the genetic elements and cellular factors that play a
role when designing a strategy to engineer a plant or microbe. The criteria to select a host and the techniques available for creating genetically modified organisms (GMOs) with
changed properties and enzymatic activities will be studied. Furthermore, the use of fermenters to achieve large-scale production of specific plant- or microbe-derived compounds will be highlighted in the course.

Course objectives

This course covers the most advanced principles, methods and techniques available to generate genetically modified organisms (GMOs). It aims at providing students with the ability to design a strategy to address an issue related to biobased materials via a biotechnology approach. At the end of the course students can:

- Explain the different characteristics of organisms commonly used for bioengineering
- Describe the molecular biology and genetic techniques used to genetically modify plants and bacteria
- Compare different production hosts and expression technologies for the optimal production of

a recombinant protein in terms of quality and quantity
- Give examples of alternative methods to isolate a recombinant protein
- Analyze the production process of a biobased material, devise a strategy to optimize it using a biotechnology approach and present it to peers
- Discuss the legal and societal implications that a specific biotechnology process might have
- Perform a genetic engineering experiment, understand the principles behind it and propose adaptations of the experimental procedures in case of unexpected results.

Recommended reading

Several textbooks could be useful for this course. However, these books are often very specific and detailed, and do not cover all the topics of the course and/or contain a large
amount of information we will not be able to cover in this course. Additionally, in this course we will make use of review and research articles.
The lectures and your notes are the most valuable resources for information. Finally, searching for academic publications (e.g. via Pubmed at https://www.ncbi.nlm.nih.gov/pubmed/) will be required to obtain all the necessary information for the tutorial tasks.

Suggested literature:
- Molecular biology of the cell. Bruce Alberts and Alexander D. Johnson. ISBN-13:978-0815344322
- Specific literature for specific assignments will be provided by the coordinator during the course.

BBM1006
Period 4
27 Jan 2025
28 Mar 2025
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- L. Bortesi

Teaching methods:
Lecture(s), PBL, Research, Skills
Assessment methods:
Presentation, Assignment, Written exam
Faculty of Science and Engineering

Advanced Macromolecular Chemistry: Biopolymers Synthesis, Modification and Characterization

Full course description

Different polymerization mechanisms: radical polymerization, ionic polymerization, coordinative polymerization, ringopening polymerization, step growth polymerizations and also polymer modification; - Copolymers and copolymerization curves; - Polymerization techniques: bulk, solution, dispersion, emulsion; - Polymer architectures: linear, block copolymer, graft copolymer, star shaped polymers, supramolecular polymers; - Polymer classes and their application fields: thermoplasts and thermosets; - Polymers in solution and phase separation; - Molecular weight determination of polymers: gel permeation chromatography with different detectors, viscometry, ...; - Application of the knowledge on biobased polymers. Description of skills training during the course: - Lab skills on polymer synthesis and molecular characterization; - Presentations skills; - Understanding publications in the field and discuss about it; - Student can search relevant information in literature and on Scifinder; - Analyze and solve problems in the field; - Student is able to choose the most appropriate polymer mechanism to make the desired polymers; - Student can choose the right molecular characterization technique(s) for the polymer under consideration; - Critical evaluation of publications and lab results.

Course objectives

- Student gains theoretical knowledge in the field of polymer synthesis and molecular characterization of polymers; - Student learns to read and understand publications in the field; - Student gains practical lab experience in polymer synthesis and molecular characterization; - Student learns to work problem solving, to evaluate work (own lab work, publications in the field) in a critical way and to search more in depth information in literature.
BBM1007
Period 4
27 Jan 2025
28 Mar 2025
Print course description
ECTS credits:
6.0
Coordinator:

- K.V. Bernaerts

Faculty of Science and Engineering

Applied Materials Science and Engineering

Full course description

This course discusses several of the topics introduced in the mandatory course "Principles in Materials Science and Engineering" (BBM1003) and highlights recent advances and extended views on the topics;

1. Structure property relations in polyesters synthesized from macrolactones
2. Mechanical performance of semi-crystalline polymers
3. Influence of polymer composition on the crystallization behavior
4. Thermodynamics of dissolution, mixing, and blending of polymers
5. Crystallization and performance of polymer blends and mixtures
6. Effects of (crystallization) morphology on performance

Through combined theory from the book Polymer Physics, review papers (links supplied on Eleum), and discussions, the students will be made aware of the effects of crystallization, phase separation and ensuing morphologies on mechanical performance on materials. Special focus is on employing the established theory and analytical insights to predict properties and performance of biomaterials. In short, this elective course continues to build the four pillars introduced in BBM1003, being:

(i) chemical structure;

(ii) characterization of polymers;

(iii) phase structure and morphology;

(iv) macroscopic properties of bulk polymers.

Several processing and characterization techniques will be discussed in the course, including extrusion, injection molding, fiber spinning, differential scanning calorimetry, dynamic mechanical analysis, polarization optical microscopy, mechanical testing and x-ray diffraction.

Course objectives

The course aims to make students aware of the different structure–property relations in thermoplastic polymeric materials, in particular for polymer blends. As the end of the course students;

1. know and are able to apply the theory related to 1) the Flory Huggins Lattice Model, 2) solution phase diagrams, 3) polymer miscibility, 4) phase stability, and 5) thermodynamics of dissolution and phase transitions, to identify the morphology of polymer blends.
2. know the theory related to the formation of 1) chain-folded crystals, 2) non-periodic layer crystals, and 3) extended chain crystals, and are able to translate these concepts to the thermal and mechanical properties of polymeric materials and blends after processing.
3. Know the effect of plasticizers, nucleating agents and reinforcing fillers on thermoplastic polymers and are able to design polymer blends with controlled thermal and mechanical performance using these additives.
4. Know the theory related to x-ray diffraction and scattering of polymer materials and are able to identify and predict blend and crystallization morphologies from 2D x-ray diffractogram, and vice-versa.
5. have theoretical understanding and the ability to perform extrusion, injection molding, optical microscopy, thermal analysis, spectroscopy and scattering analysis techniques for the generation of polymer blends and identification of their morphology.
6. are able to 1) design and execute experiments and 2) employ the generated experimental findings to provide scientific argumentation required to prove or disprove a hypothesis.

Recommended reading

- Polymer Physics, M. Rubinstein, R.H. Colby, Oxford Univ. Press
- http://pubs.acs.org/doi/abs/10.1021/ma048884k
- https://pubs.acs.org/doi/10.1021/acs.macromol.5b02419
- http://physicstoday.scitation.org/doi/10.1063/1.882522
- http://www.sciencedirect.com/science/article/pii/S0079670011001444
- http://www.sciencedirect.com/science/article/pii/007967009400032W
- http://www.sciencedirect.com/science/article/pii/S0079670005000717
- http://pubs.acs.org/doi/abs/10.1021/ma035279t
- http://www.sciencedirect.com/science/article/pii/0032386192905528
- http://pubs.acs.org/doi/abs/10.1021/ma500433e

The list of literature is subject to change and depends on the actual content of the guest lectures.

Biobased Materials

BBM1008
Period 4
27 Jan 2025
28 Mar 2025
Print course description
ECTS credits:
6.0
Coordinator:

- J.A.W. Harings

Teaching methods:
Lecture(s), PBL, Research, Skills
Assessment methods:
Written exam, Final paper
Faculty of Science and Engineering

Biomedical Materials

Full course description

This course aims at introducing the students to the field of biomedical materials. Biobased materials have not been applied widely in a medical context, but there is example like poly(lactic acid) (PLA). The currently used biomedical materials include: metals (skeletal implants), ceramic materials (dental/orthopaedic), hydrogels (coatings, drug delivery), fibers (surgical patches, wound dressings), and high-grade polymers (tubings, catheters, etc.). The introduction of novel materials in biomedical applications has proven to be complicated and slow. The requirements for the materials and their synthesis are very strict to reduce the risk for the patient. Furthermore, the materials have to possess specific properties that ensure the biocompatibility of the material. This does not mean a lack of toxicity, but also prolonged functionality over the intended period of use. The course also aims to teach the students the basic principles of effective communication between materials scientists and medical doctors. The translation of material development into a usable implant in the clinic is the ultimate goal of biomedical material development. With this course, we will set the first step in that direction by teaching the required “biomedical” language for a (biobased) materials specialist.

Course objectives

The main objective is to get a deep and funded feel for how biomedical materials should be synthesized, analyzed, processed and applied in order to be functional in a medical application. For this, the major “problems” that a biomedical material can encounter will be studied in this course. The course specific intended learning outcomes (ILOs) are:

1. The students will be able to improve their knowledge and comprehension on the nature and prerequisites of biomedical materials.

2. The students will gather the skills to analyze research literature describing biomedical materials and the possibilities of biobased materials in biomedical applications.

3. The students will demonstrate the ability to plan and perform an individual high-level scientific

research project in the biomedical field, specifically, to make a new biobased material with antibacterial properties.

4. Students will practice the scientific method by writing hypotheses, collecting and analyzing data and troubleshooting when needed.

5. Students effectively communicate both in writing through a written report describing the results, conclusions and the relevance of the conducted research, and orally in a final presentation.

Recommended reading

Mandatory Literature:
- Biomaterials Science by B. Rattner, AS Hoffman, FJ Schoen, JE Lemons. 3rd ed. (2013) Academic Press (Elsevier) Waltham, MA, USA
A copy of this book will be available in the master lab. Please do not take the book home, so that all of you can look at it. Copies of important parts will be made available (Electronically)

Additional Literature:
tbd

BBM1009
Period 4
27 Jan 2025
28 Mar 2025
Print course description
ECTS credits:
6.0
Coordinator:

- K. Saralidze

Teaching methods:
Lecture(s), PBL, Research, Skills
Assessment methods:
Final paper, Presentation, Written exam, Assignment
Faculty of Science and Engineering

Organic Coatings: Modification and Spectroscopical Analysis

Full course description

This course is an elective course open to students of the master biobased materials. For this course, basic knowledge in organic chemistry is required as well as basic knowledge in materials science (course Principle of Materials Science). The course Macromolecular Chemistry is a good course to be followed before taking this course, though it is not obligated.

Content:
- colloids and interface chemistry
- properties of coatings
- coating formulation I

- coating formulation II
- film formation, solvent borne coatings, high solids coatings and waterborne coatings
- radiation curable coatings, powder coatings and electrodeposition coatings
- characterization of coatings

Course objectives

At the end of the course, the students should be able to:
1. recall and apply theoretical knowledge in the field of surface chemistry (organic coatings) and characterization;
2. identify and discuss, in the frame of a scientific publication, what the research approach has been, which means have been used and why, to solve a question in the field. The student must be able to present this to a broad audience and prove his critical attitude;
3. know how to change surface properties to gain the desired properties;
4. learn to have an helicopter view over (lab) results of himself and his colleagues and is able to present (oral presentation) those different lab experiments as well as the corresponding results in a systematic way;
5. efficiently plan and design lab work;
6. make notes during lectures and when things are explained to them e.g. during tutorials, things that are not mentioned in full detail in the slides, ...

Recommended reading

Mandatory Literature:
The PowerPoint files and tutorial group instructions will be available on CANVAS. We will also make use of scientific publications in the field.
These PowerPoint files form the core of this class and as such, in addition to the tasks the most important study material.

Recommended textbook:
Zeno W. Wicks Jr., Frank N. Jones, S. Peter Pappas, Douglas A. Wicks, Organic Coatings: Science and Technology 3rd Edition

BBM1011
Period 5
31 Mar 2025
23 May 2025
Print course description
ECTS credits:
6.0
Coordinator:

- K.V. Bernaerts

Teaching methods:
Lecture(s), PBL, Research, Skills
Assessment methods:
Written exam, Assignment
Faculty of Science and Engineering

Nano-Science and Nano-Technology: (Bio)Polymers and (Bio)Composites

Full course description

Nanotechnology and nanoscience entails substantially more than descending geometrically to nanometer length-scale. In fact, the yet emerging field of nanomaterials, as well from technological as scientific perspective, brings chemists, physicists, material scientists and engineers, biologists, medical scientists, and surgeons together. It is this multi- and inter-disciplinary aspect of nanotechnology and nanoscience in particular that sets half the framework of the course, providing the necessary tools/foundation to meet the learning goals described below.

The second half of the framework relies on targeting (bio)polymer nanocomposites. As a consequence, the road in reaching the learning goals and examination is conceptual, and may sometimes even be philosophical in nature. Here I wish to phrase the elementary learning goal once more: “master the intimate relationships between various scientific disciplines, which at first sight may seem unrelated, uniquely merging in nanoscience and technology and directed to bio-inspired nano-structure induced functionality”.

Nature treasures myriads of astonishing material functionalities expressed at macroscopic length-scale but originating from cooperative hierarchical structure effects down to nanometer length-scales. The structural organisation across various length-scales defines these natural materials as being composites where properties of the different constituents cooperatively contribute to added functionalities. For decades, material scientists have been intrigued by the functionalities of plant, animal, microbial and biomineralized constructs with unique structural elements at nanometre length-scale. Whether being alive or not, these constructs are products of evolutionary optimisation for survival and reproduction.

Via which unique combination of analytical techniques did the scientific community link biological macroscopic functionality to nano-structured design? Why is the targeted material functionality only accessible via nano-metric design? How do physical phenomena change at nano-meter length-scales? Is the biological functionality reserved for biobased composite constituents only? What is the optimum synthetic reproduction strategy and proof for technical implementation? Geared with the lecture and PBL content, you shall answer all these questions for your personally selected nano-structured biocomposite to ultimately lecture eachother.

Course objectives

The ultimate goal of the course is the understanding of the intimate relationships between various scientific disciplines, which at first sight may seem unrelated but that uniquely merge in nanoscience and technology, fostering unique effects at various, but specially nanometer length-scales. The specific focus is, but is surely not limited to, bio-inspired nano-structured induced material functionalities.

Seven Intended Learning Outcomes (ILOs) are defined:

Biobased Materials

1. Manage (S) (dis)advantages of materials design at nanometer lengths-scale.
2. Justify (S) various fabrication strategies for the making of nanostructure induced material functionalities – synthetic, natural and bio-inspired.
3. Understand (K) the concepts of, and predict (A) molecular self-assembly, its thermodynamics and kinetics, and the role of non-covalent inter and intramolecular forces.
4. Appraise (S) the (dis)advantages of characterization methods in relation to resolve questions at the nano-meter length-scale by fundamentals of advanced spectroscopic and microscopic methods, bridging our understanding at molecular and microscopic length-scales.
5. Explain (K), predict and apply (A) the relationships between nano-structures and material functionalities properties in biological and technological context.
6. Interpret (A) and critically assess (S) peer-reviewed research papers.
7. Design and report the fabrication and analytical verification of nano-filler functionalized polymeric composites

Recommended reading

Mandatory Literature:

- L. Cademartiri and G. A. Ozin, Concepts of Nanochemistry, Chapter 1, Wiley-VCH Verlag GmbH, 2009, ISBN: 978-3-527-32626-6.
- C. Bréchignac, P. Houdy, M. Lahmani (Eds.), Nanomaterials and Nanochemistry, European Materials Research Society, Springer Berlin Heidelberg New York, 2006, 978-3-540-72992-1.

Additional Literature:
Peer-reviewed publications referred to in the lecture notes and individually selected for support of the final assignments.

Please note that the course content connects cutting-edge developments in natural sciences and engineering to fundamentals in the fabrication and characterization of nano-structured materials using a common language that is unique to the BioBased Materials Science Master of Maastricht University. Consequently, a single comprehensive source of literature that cover all does not exist. Take ownership in the collection and securing of study material.

BBM1012
Period 5
31 Mar 2025
23 May 2025
Print course description
ECTS credits:
6.0
Coordinator:

- J.A.W. Harings

Teaching methods:
Lecture(s), PBL, Research, Skills
Assessment methods:
Written exam, Assignment
Faculty of Science and Engineering

Sustainability of Biobased Materials

Full course description

Bio-based materials are promising sustainable substitutes for fossil based materials. Biomass is an abundant renewable resource for bio-based materials, thereby creating a continuous loop of CO2 sequestration and CO2 emission with anticipated reduced net greenhouse gas emissions. They also offer the option for (enzymatic) green production routes and can provide an additional waste strategy, i.e. biodegradation. In addition, bio-based materials offer economic development potential, e.g. for rural areas. However, bio-based materials are not intrinsically sustainable. Sustainability issues like competition with food security and reduced biodiversity have already been identified and should be taken care of when further developing the bio-based economy. Hence, sustainability assessment is essential to develop bio-based materials that are also sustainable.

Life Cycle Assessment (LCA) is a recognized and standardized methodology to quantify the environmental impacts of a product. LCA considers the entire life cycle of a product and is a valuable tool to avoid shifting environmental impacts from one life cycle stage to another stage. LCA also supports decision makers to avoid creating a new environmental issue while solving a current environmental issue.

In this course, students will acquire a thorough understanding of LCA, including the main strengths and weaknesses. They will be able to use LCA as method and tool for analysis of the environmental impacts from products and technical systems. They will know the most frequent uses of LCA in industry and regulation and obtain concrete skills in the application of the methodology and tools to perform an LCA as well as in the use of LCA results produced by others. Students will also be acquainted with LCA-derived methods for economic and social impact assessments.

Course objectives

At the end of the course, students should be able to:
1. describe the four stages of life cycle assessment (LCA) and explain the important aspects in each phase (e.g. functional unit, system boundaries (allocation, system expansion), impact assessment methods) (knowledge)
2. to review of an LCA study from the scientific literature or industry highlighting the strengths and weaknesses and explaining how the results should be interpreted and can be used in other LCA studies (understanding)
3. explain what important parameters are for the LCA studies of biobased materials (understanding)
4. moderate a debate and take part in debates of other students on a sustainability topic related to (biobased) materials (evaluating)
5. develop and perform a LCA study on a research topic related to (biobased) materials (application, creation)
6. present a LCA case study on a poster and orally present it in a seminar (communication)
7. work pro-actively and independently on a challenging research project

Recommended reading

We will make use of handbooks, scientific articles, and official reports of governmental organisations, companies or expert committees. All course materials will be provided by the course coordinators or links to online materials will be provided in the manuals or on Canvas. The following online resources are frequently used in the course and/or provide interesting background information:

- Handbook Chapters from a book on essential concepts of sustainability: Tom Theis and Jonathan Tomkin, Editors, Sustainability: A Comprehensive Foundation. OpenStax CNX. 06.jan.2015 http://cnx.org/contents/1741effd-9cda-4b2b-a91e-003e6f587263@43.5. The book can be read online and is downloadable as PDF or EPUB file.
- Handbook - General guide for Life Cycle Assessment. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. First edition March 2010. EUR 24708 EN. Luxembourg. Publications Office of the European Union; 2010. The pdf file is available at: http://eplca.jrc.ec.europa.eu/uploads/ILCD-Handbook-General-guide-for-LCA-DETAILED-GUIDANCE-12March2010-ISBN-fin-v1.0-EN.pdf
- Free online textbook on LCA “Life Cycle Assessment: Quantitative Approaches for Decisions That Matter”, by H. Scott Matthews, Chris T. Hendrickson, and Deanna H. Matthews, available at www.lcatextbook.com. The book provides an introduction and substantive quantitative examples for all components of life cycle assessment.
- Complementary information available at the website of the European platform on Life Cycle Assessment : http://eplca.jrc.ec.europa.eu/?page_id=86

Additional materials will be provided by the course coordinators or will be searched and selected by the students.
Maastricht University students have off-campus access to protected services and resources, like databases, e-journals and e-books of the UM Library. Different solutions are provided for remote access: Direct Library login, Library Access Browser Extension, Student Desktop Anywhere (SDA) and Virtual Private Network (VPN). All information is provided on the website: https://library.maastrichtuniversity.nl/services/remote-access/

BBM1013
Period 5
31 Mar 2025
23 May 2025
Print course description
ECTS credits:
6.0
Coordinator:

- Y. van der Meer

Teaching methods:
Lecture(s), Skills, Work in subgroups
Assessment methods:
Assignment
Faculty of Science and Engineering

Plant-derived Building Blocks

Full course description

This course provides students with insights and knowledge on general and fundamental aspects of plant derived materials and building blocks. These may include fibers, natural polymers and other bulk material harvested from plants, but also interesting secondary metabolites like terpenoid- and alkaloid-based building blocks. Sustainable industrial utilization of these may drive knowledge generation on how to convert our fossil-based organic chemical industry towards a more sustainable biobased industry. Future materials will contain other building blocks than we are using today, giving materials with substituted or outperforming (combinations of) functionalities.

Course objectives

This course combines elements of biology, bio-organic chemistry, material science and biochemistry to make students familiar with fundamental aspects including structural and functional characteristics, (bio)synthesis and applications of materials and building blocks derived from plants. The structure/function relationship of the natural products and bio based building blocks as well as their extraction, production and utilization in material science will be studied and analyzed.

At the end of this course, student should be able to:

1. Describe biosynthetic pathways in plants for the production of the main classes of primary and secondary metabolites
2. Recognize from the structure the different classes of natural products and biobased building blocks including carbohydrates, fatty acids and lipids, polyketides, alkaloids, terpenoids & steroids, (poly)phenolics & flavanoids
3. Understand the general concepts of biosynthesis/biotechnology and its relevance for biobased building blocks or biobased materials
4. Describe the different types of plant-derived materials and correlate their structure /composition with their function in the plant and in the final material application.
5. Explain how materials and building blocks can be derived from plant biomass and illustrate the concept of biorefinery
6. Research and communicate a scientific topic in a clear and concise way to a group of scientific peers.
7. Perform a bioextraction/synthetic application of a plant derived building block towards a functional material, analyse the experimental data and report the results

Recommended reading

Mandatory Literature
The lectures and your notes are the most valuable resources for information. Relevant literature and study material will be provided during the course.

Several lectures are based on the following book:
Introduction to chemicals from biomass, 2nd edition (2015) James Clark & Fabien Deswarte

Additional Literature
Specific literature for specific assignments will be provided during the course.

BBM1004
Period 5
31 Mar 2025
23 May 2025
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- R.V.A. Orrù

Teaching methods:
Lecture(s), PBL, Skills
Assessment methods:
Final paper, Presentation, Written exam
Faculty of Science and Engineering

Biopolymers

Full course description

Alternative feedstocks to conventional fossil raw materials have attracted increasing interest over recent years for the manufacture of chemicals, fuels and materials. The growing attention about a green and sustainable chemistry has also contributed to call attention to biomass and specifically on lignocellulosic feedstock as a promising, renewable and vast resource for chemicals, mainly without competition with food applications. The concept of biorefinery can be defined as “an integral unit that can convert biomass into bio-based products including food, feed, chemical and/or materials, and bioenergy such as biofuels and power”. The aim of this emerging concept is to use the lignocellulosic biomass by separating its main constituents with increased value provided by its components of cellulose, lignins, hemicelluoses and xylose. This concept of a biorefinery falls within the approach of green chemistry, avoiding the production of waste low value-products and recycling solvents used to extract all the components of biomass feedstock. Another valuable source of the building blocks for the new materials is animal industry byproducts. Efficient utilization of animal industry byproducts has direct impact on the economy and environmental pollution. For example, treated fish waste has found many applications among with which the most important are biodiesel/biogas, dietectic products (chitosan), natural pigments (after extraction) and cosmetics (collagen).

Course objectives

This course is a course that combines biochemistry and organic chemistry in carbohydrates and materials that can be obtained from carbohydrates and proteins.

The course-specific intended learning outcomes (ILOs) are:

Biobased Materials

1. The students will be able to obtain and improve their knowledge and comprehension of carbohydrates and animal derived biopolymers.
2. The students will gather the skills to analyze research literature describing carbohydrate/protein derived materials and the possibilities of biobased materials in different applications.
3. The students will demonstrate the ability to plan and perform an individual high-level scientific research project in the field of biopolymers, specifically, to make a new biobased material with superabsorbent properties.
4. Students will practice the scientific method by writing hypotheses, collecting and analyzing data and troubleshooting when needed.
5. Students effectively communicate both in writing through a written report describing the results, conclusions and the relevance of the conducted research, and orally in a final presentation.

Recommended reading

Mandatory Literature:

- Biochemistry& Molecular Biology of Plants (2nd ed.; 2015) B.B. Buchanan, W. Gruissem, R.L. Jones. Wiley Blackwell, Paperback ISBN: 9780470714218, Hardback ISBN: 9780470714225
- Carbohydrates: The essential molecules of life (2nd ed.; 2009) R.V. Stick & S.J. Williams. Elsevier, Oxford, UK. ISBN: 978-0-240-52118-3
- Molecular Biology of The Cell (6th ed.; 2015) B. Alberts, A. Johnson, J. Lewis, D. Morgan, M. Raff, K. Roberts, P. Walter. Garland Science Taylor & Francis Group, Hardcover ISBN: 978-0-8153-4432-2, Paperback ISBN: 978-0-8153-4464-3
- Lehninger Principles of Biochemistry (7th ed., 2017) D.L Nelson, M.M. Cox, Freeman, W. H. & Company ISBN-10: 1464126119

Additional Literature:
tbd

BBM1015
Period 1
2 Sep 2024
25 Oct 2024
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinator:

- K. Saralidze

Teaching methods:
Lecture(s), PBL, Research, Skills
Assessment methods:
Written exam, Presentation, Final paper
Faculty of Science and Engineering

Polymer Processing

Full course description

Biobased materials are the basis for biobased products. The master program Biobased Materials provides a broad overview of different aspects of the production and evaluation of biobased materials. The elective Polymer Processing deals with the processing of polymers into products and thus closes the gap between materials science and product development.

The material structure, the processing parameters and the desired product properties are usually interdependent. The properties of the materials are usually strongly influenced by the manufacturing processes. The drawing of fibres during their production for example, leads to much higher orientation of the material and ant the end much higher tensile strength as other processes like for example injection moulding.

Processing machines have to be seen as tools for producing products with certain desired polymer properties. The essential processing methods of the plastics industry (including textiles) are described in this course. To support the understanding of polymer processing fundamentals of rheology are covered.

Course objectives

At the end of the course we expect students will be able to:

Knowledge (K), Application (A), Analyse (An), Soft skills (S)

1) Explain standard processes in the (bio)polymer processing industry and standard processes of textile manufacturing” (K) and set up production chains (A)
such as: extrusion, injection molding, fiber spinning, etc. and such as natural fiber production, yarn production and the manufacture of textile fabrics such as woven
fabrics, knitted fabrics, multi-axial fabrics, etc.
2) Choose the right material and to choose suitable processes for a particular product” (A).
3) Describe structure formation during processing” (K) and design processes (A) During the production of products from biopolymers their structure is influenced. For
example, more or less amorphous phase can be adjusted by cooling more or less during solidifying polymer melts. This has consequences for properties such as
optical transparency or brittleness of materials. And the end of the course of the participants are able to explain the structure formation for all processes, to choose
the right processes and to analyse running processes from ILO 1).
4) Present their results and to give helpful feedback to colleagues” (S) Effective communication is communication that is perceived by the other as it is meant by communicators. For this, it is necessary to communicate in a way that is appropriate for the addressee. After completing the course, the participants will have
the ability to address different sensory channels (hearing, seeing, …) and to create effective

presentations. The essential prerequisite for personal development is to
evaluate feedback from the environment, i.e. to consciously deal with it and to implement things or to consciously refrain from doing so. The basis for this is to
formulate helpful feedback that can be accepted by the addressee. Participants of the course get to know tools to give helpful feedback and are able to apply them.
5) Describe the conditions of industrial production facilities" (K) After completing the course, students have a basic understanding of the practical
constraints of industrial production. They are able to consider the practical boundary conditions of industrial production during the development of production processes.
6) The participants will know and be able to apply (A) "basic concepts of rheology on polymer processing problems (K).

Recommended reading

Mandatory Literature:
The books will be used partly! Not 100 % of the books are relevant.
The relevant parts will be defined during the lectures.

1. Book, Recycling of Polymers: Methods, Characterization and Applications 1. Edition, Raju Francis, ISBN-10: 3527338489 and ISBN-13: 978-3527338481, Hardcover: 288 pages

2. Book, Understanding Polymer Processing 2E: Processes and Governing Equations

2. Edition, Tim A. Osswald, ISBN-10: 3662463407 and ISBN-13: 978-3662463406, Flexibound: 362 pages

3. Textile Materials for Lightweight Constructions: Technologies - Methods - Materials - Properties 1. Edition, Chokri Cherif, ISBN-10: 3662463407 and ISBN-13: 978- 3662463406, Hardcover: 677 Seiten

4. Rheology book not chosen yet.

Additional Literature:
Lecture material created by G. Seide will be distributed.

BBM1016
Period 1
2 Sep 2024
25 Oct 2024
Print course description
ECTS credits:
6.0
Coordinator:

- G.H. Seide

Teaching methods:
Lecture(s), PBL, Research, Skills

Biobased Materials

Assessment methods:
Final paper, Written exam
Faculty of Science and Engineering

Commercialization and Entrepreneurship

Full course description

At Commercialization & Entrepreneurship, we combine the best aspects of Lean Startup Methodology, Business Model Canvas, Customer Development with our own insights and experience.

The program curriculum is aimed at crafting a strong sustainable, business model. It is a combination of masterclasses and work sessions. The aim is that you validate your assumptions between masterclass and work session. Rapid iteration will allow your project to stay lean and achieve your goals considerably faster.

Course objectives

At the end of this course, students will be able to:

1. Create and validate your Business Model

During the course you will build and validate your first business model around your innovative idea.

We make use of the Business Model Canvas (BMC) tool to plot the Business Model. With the BMC you will be able to present your business model quickly and clearly and you learn to speak the language of entrepreneurs and investors. It also gives you the knowledge to read other people’s business models and ask the right questions.

2. Know your Value Proposition. Determine the real value you offer to your customers

The Value Proposition is the core of your Business Model. To define your Value Proposition you need to understand your customer(s). What are their pains? What can they gain from your product or service? You will analyse your customers’ situations and the value chain in which they are operating to build the right Value Proposition.

3. Research the Business Model Environment. Analyze trends and developments that are relevant for your business

You need to understand the world around you to act. To build that understanding you will analyze trends and developments which are relevant for your business. Investigation of topics such as regulatory changes, the impact of the circular economy, and digitization, will define the right directions for your business. You will translate this into opportunities and act accordingly.

4. Validate your Assumptions through interviews with relevant stakeholders. You will become more specific and concrete

You have to validate all assumptions made from behind your desk. Real feedback on your ideas comes from talking to people. Talking to potential customers, partners, and to experts, is the way to research if your idea is the right idea. Based on the feedback you may need to iterate, pivot or continue.

5. Create a strong story and give a pitch

Storytelling & Pitching are essential in bringing your product to the market. You need to convince customers, partners, investors and others that you are the right person and that your product is the best solution. You need to build a story for the right audience. And you need to pitch in the right way. Each audience requires a different approach. On a weekly basis you present your progress to the other students and during the program you will need to discuss your project with experts and potential partners and customers.

Recommended reading

Mandatory Literature:

None

Additional Literature:

1. The Start-up Owner's Manual. Vol. 1, by Steve Blank & Bob Dorf
2. Business Model Generation, by Alexander Osterwalder & Yves Pigneur
3. Value Proposition Design, by Alexander Osterwalder & Yves Pigneur

BBM1017
Period 1
2 Sep 2024
25 Oct 2024
Print course description
ECTS credits:
6.0
Instruction language:
English
Coordinators:

- R.P.M.G. Broersma
- J.W. Foppen

Teaching methods:
Lecture(s), PBL, Research, Skills
Assessment methods:
Presentation, Assignment
Projects

Projects

Faculty of Science and Engineering

Research Project 1

Full course description

The projects are based on research based model (RBL). In this model, you are challenged with a real-life problem and have to come up with a creative solution to this problem. You have to take ownership and responsibility to make it a worthwhile learning experience. Not only will you learn how to perform a number of techniques but you will also gain an understanding of how to think like a scientist. Throughout the project period, you will learn what it is like to work, think, and learn in an actual laboratory setting. It is common to you experience that “science by doing” is challenging, sometimes a bit frustrating, but above all fun. This way of working is very challenging, but It also offers opportunity to learn work in team sharing responsibilities, which is very important not only in your future careers, but in your lives in general. Furthermore, in the projects, you have to use all knowledge and skills gathered in the programme up to that point. Only when you work together and use all information, you can truly excel, propose and execute a project that surpasses the regular master level. Especially innovation and creativity are important, as well as solid scientific method and proper argumentation and discussion. This way of organizing projects means that you not only execute the project, but also design it. The success of the project depends on your enthusiasm and motivation.

PRJ4001
Period 3
6 Jan 2025
24 Jan 2025
Print course description
ECTS credits:
6.0
Coordinator:

- K. Saralidze

Faculty of Science and Engineering

Research Project 2

Full course description

The projects are based on research based model (RBL). In this model, you are challenged with a real-life problem and have to come up with a creative solution to this problem. You have to take ownership and responsibility to make it a worthwhile learning experience. Not only will you learn how to perform a number of techniques but you will also gain an understanding of how to think like a scientist. Throughout the project period, you will learn what it is like to work, think, and learn in an actual laboratory setting. It is common to you experience that “science by doing” is challenging, sometimes a bit frustrating, but above all fun. This way of working is very challenging, but It also offers opportunity to learn work in team sharing responsibilities, which is very important not only in your future careers, but in your lives in general. Furthermore, in the projects, you have to use all knowledge and skills gathered in the programme up to that point. Only when you work together and use all information, you can truly excel, propose and execute a project that surpasses the regular master level. Especially innovation and creativity are important, as well as solid scientific method and proper argumentation and discussion. This way of organizing projects means that you not only execute the project, but also design it. The success of the project depends on your enthusiasm and motivation.

PRJ4002
Period 6
26 May 2025
13 Jun 2025

Biobased Materials

Print course description
ECTS credits:
6.0
Coordinator:

- K. Saralidze

Thesis

Master Thesis Research

Faculty of Science and Engineering

Master Thesis Biobased Materials

Full course description

The curriculum of the Biobased Materials culminate in a Master thesis research project (from hereon termed: Master thesis). This part of the curriculum is a final proof-of-capability for the Master students. It allows the students to demonstrate that they have gained sufficient knowledge, competences and skills to perform independent scientific research and become an independent thinker. During the Master thesis, the students prepare for the next step in their career. The Master thesis comprises 28 weeks of work (total of 32 weeks between execution and presentation/defenc of the second year of the curriculum and accounts for 48 ECTS of the Master degree.

The student should carry out the project autonomously under guidance of a thesis research supervisor, a member of the receiving academic or industrial research institution/group. Each student carries out their own Master's Thesis Project, even in case of a complex project carried out by a team of scientists/students.

Thesis projects can be carried out under supervision of UM research groups, or at other faculties, universities, research institutes or companies in the Netherlands or abroad. Irrespective of the internship location or organization, the topic of the thesis should be scientific and directly related to the scientific field of the Master programme (e.g. Systems Biology or Biobased Materials) and its competences. The topic for the Master thesis is chosen by the student in close consultancy with a research supervisor. A short description of the topic is submitted to the thesis coordinator using the Master thesis information form (as described below). The thesis coordinator is responsible for checking the alignment of the submitted thesis topic with the Master programme goals and competences.

During the Master thesis, the students will complete the following tasks:

- write a research proposal, which includes a clear scientific background overview on the thesis topic (including knowledge gaps), research question/aim, hypothesis, rationale and a manageable research plan (methods, analysis, time plan);
- execute the research plan and troubleshoot encountered problems to improve and develop the project;
- analyse and process data and report the results, discuss results in the context of the existing literature in the field, and elaborate conclusions in a written Master thesis report;
- present and defend the thesis project in an oral presentation

Course objectives

The Master thesis is an individual research project in which the students should be able to:

- Demonstrate the ability to plan and perform an individual high-level scientific research project in the pertaining field;
- Develop team-work and communication skills by participating as an active member of a research group;
- Practice the scientific method by writing hypotheses, collecting and analysing data and troubleshooting when needed;
- Effectively communicate science both in writing through a written Master thesis report describing the results, conclusions and the relevance of the conducted research, and orally in a thesis defence presentation.

BBM5000
Semester 2
3 Feb 2025
4 Jul 2025
Print course description
ECTS credits:
48.0
Instruction language:
English
Coordinator:

- K. Saralidze