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Bio-based research and technology development (RTD), innovations and business models
SYLLABUS

Study subject No: **4.1.**

Responsible Unit: Latvia University of Life Sciences and Technologies, Latvia (LBTU)

Credits and distribution of academic hours:

	ECTS	Contact hours		Independent study hours	Total hours
		Lectures	Practical works or seminars		
LBTU	3	14	13	63	90
JAMK	2	10	8	42	60
Total	**5**	**24**	**21**	**105**	**150**

** 1 ECTS = 30 hours (9 contact hours and 21 independent hours);*
1 academic hour = 40 minutes;
Theoretical lectures not less than 50% of contact hours

Course developers:
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JAMK University of Applied Sciences, Finland (JAMK), **Mari Hakkarainen, Lecturer**

Notes: General study course for the master programme Bioeconomy.

Prior knowledge: Bio-products and bio-based value chains, Circular economy.

Annotation: The study course provides knowledge about bio-based innovation, its role in the economy. Understanding of bio-based innovation system development, interaction of its system elements and operational support system. The study course covers the full cycle of innovation, starting from the development and research of a, idea with commercialization potential, ending with the selection of an appropriate business model.

The student will understand the importance of understanding customers and their needs. After accomplishing this course the student will know the basics and phases of customer oriented design methods in problem solving and product development to create concepts with added value for the customer. The student will be able to apply the customer oriented design method into practice. The student will be familiar with innovation processes and methods. The student will be able to examine the business opportunities of existing and new circular economy processes and test them with possible customers.

The aim: Providing students with knowledge on bio-based innovation, customer-oriented design thinking, emphasizing the importance of research and technological development, acquiring professional skills and skills needed for a successful bio-based business.

Description of the organization and tasks of students' independent work:

1. Students should write a report on the most important findings after a video meeting with Latvian and Finnish innovation experts.
2. Students prepare and present their country's innovation ecosystem or its elements.
3. Transformation of the results of a scientific article into information for different target groups (communities of practise) of the society.

Learning outcomes (knowledge, skills and competences)

Learning outcome	Assessment method	Level of achievement		
		Average	High	Very high
KNOWLEDGE				
Students will be able to: Demonstrate the knowledge and understanding of the substance and concepts of a bio-based innovation system.	Test (multiple choice)	40-69% knowledge and understanding of the concepts used	70-89% knowledge and understanding of the concepts used	90-100% knowledge and understanding of the concepts used, close familiarity with how to apply them
Demonstrate the knowledge and understanding of Innovation methods	Independent and group work: case study about circular economy solutions and customers' exp ectations to them	Knowledge of customer oriented innova tion methods	Ability to adapt design thinking process or other innovation method as a part of business plans	Ability to critically review innovation processes as a tool to find business possibilities in circular economy
SKILLS				
Professional skills				
Independently identify the knowledge needed for an innovation and come up with solutions to acquiring it	Independent work (presentation)	Superficial description of the market pull and science push factors needed for innovation is given	In-depth description of the market pull and science push factors needed for innovation is given	Ability to complexly analyse the effects of market situations and scientific progress on innovation and come up with creative solutions to product platform development
Demonstrate the knowledge and understanding of the role of R&D in the development of enterprises, technology transfer and innovation	Reports on discussions with experts	Superficial knowledge of the role of R&D in enterprise technology transfer and innovation	In-depth knowledge of the role of R&D in enterprise technology transfer and innovation	Ability to complexly analyse innovation and knowledge transfer, linking it the development of enterprises
Demonstrate the ability to organize and implement customer oriented circular economy solutions	Independent and group work: case study about circular economy solutions and	Ability to plan a design thinking process	Ability to implement a design thinking process	Ability to critically review customers' expectations to circular economy solutions

	customers' expectations to them			
Soft skills				
Responsibly plan the completion of the assignments given	Independent work (presentation)	Difficulty in planning their own time and meeting deadlines	Deadlines are met, yet the assignments given are done inaccurately and superficially	Deadlines are met and the assignments given are done accurately
Engage in group work and assume responsibility for the results and an analysis of the group work	Practical assignments	Difficulty in engaging in group work and no ability to apply the acquired knowledge to analyse the results of the group work	In some matters, an insufficient understanding of how to independently apply the acquired knowledge to analyse the results of group work	Active, responsible and focussed participation in group work, which contributes to creative thinking and an opportunity to learn from each other
COMPETENCE				
Integrate knowledge from various fields for the purpose of development of knowledge management systems and of innovation	Independent work (presentation)	Some ability to integrate knowledge and come up with solutions to developing a knowledge management system	Good ability to integrate knowledge, which allows identifying necessary changes and select strategies and technological tools for implementing the changes	Ability to demonstrate an original, practical and integrated perspective on the development of a knowledge management system and innovation

Requirements for awarding credit points: The student has to pass two tests, as well as complete and submit practical assignments performed during practicals, to complete an independent assignment and present it in practicals.

Knowledge assessment and prerequisites for taking a test or examination

The final mark in the course is based on cumulative score: Activity during lectures (10%), Activity during practicals/seminar (20%), 2 tests (20% each), individual independent work and a presentation (30%). 10% are equal to one point on a 10-point marking scale.

Topic	Type of assessment	Maximum score	Assessment deadline
Activity in lectures and seminars	Participation and activity in discussions	10	During the entire semester
Assignments in seminar classes	Practical assignments during classes and at home	20	During the entire semester
Topics 1-6	Test	20	Within the specified time for the test
Independent works	Individual independent work	50	Within the specified time for presentations
Formal test with a mark			
Total		100	-

A score of 10 is equal to one point on a 10-point marking scale.

The course contents

1. Lectures

1. The concept of innovation. Knowledge-based economy, its features. Definitions of innovation. Innovation process and necessity, features and characteristics. The role of innovation in the development.
2. Bio-based innovation ecosystem. Concept of Bio-based innovation ecosystem. Economic agents of bio-based ecosystem and relations.
3. Key drivers of bio-based innovation. Economic, social and environmental challenges for the sustainable development of society.
4. Creativity and nature inspired innovation. Rolle of creativity in innovation. Prerequisites for creating a creative environment in the company. Biomimicry.
5. Bio-based industries, emerging technologies. A brief overview of the latest trends in the bioeconomy sectors (from microbiome to space technology).
6. Multidisciplinary challenges of bio-based research. Communication challenges and opportunities to overcome them in interdisciplinary research. Example of Marginal Abatement Cost Curve implementation in policy.
7. Tools to support bio-based research and technology development &innovation. Introduction of BLOOM Outreach & Engagement Toolbook.
8. Intellectual property rights for bio-based products. IPR guidelines locally and globally.
9. Research spill-overs as start-up business' seeds. Examples of research-based start-ups and their paths, the critical points.
10. Framing the business models with different tools i.e. Value Proposition Design and Design Thinking. Customer oriented design methods and how to implement them in new biobased business ideas.
11. Understanding the value and utility of customer analysis. How to design a useful customer analysis and test of new biobased business ideas.
12. Building the business models in the sustainable frames of biodiversity, ecosystems and circular economies. Designing a customer oriented business concept that includes the sustainable development aspects.

2. Practicals

1. The role of innovation in the development of society. Discussion of the most important innovations, their role, advantages and disadvantages.
2. Video discussion with an expert from the Knowledge Transfer Centre or Innovation Incubator.
3. Analysis of a bio-based innovation that solves a sustainability problem.
4. Students prepare and present their country's innovation ecosystem or its elements.
5. Attribute method to promote creativity in product design.
6. Students in groups (3-4 students) prepare their vision of the necessary directions of technology transfer in Uzbekistan.
7. Transformation of the results of a scientific article into information for different target groups (communities of practise) of the society.
8. Based on earlier lectures' information, defining a bioeconomy business challenge that will be solved using innovation methods.
9. Examining the customer needs and expectations about the defined challenge.
10. Designing user oriented ideas, concepts and solutions for the defined challenge.
11. Testing the solutions with potential customers and redesigning the concepts.
12. Presenting the results to the group.

List of sources of training, methodological and scientific literature and information

Compulsory reading:

1. Lewandowski I. (2018) Bioeconomy. Shaping the Transition to a Sustainable, Biobased Economy. Springer. pp 354
2. Sillanpää, M., Ncibi, C. (2017) A Sustainable Bioeconomy. The Green Industrial Revolution. Springer. pp 343
3. Joe T., John R. B. (2018) Managing Innovation: Integrating Technological, Market and Organizational Change, 6th Edition. John Wiley & Sons, Ltd. pp 608

Further reading:

1. Friedemann Polzin. (2016) Addressing Barriers to Low-Carbon Innovation: Essays on Structures and Policies to Mobilise Private Finance. Pl Academic Research. pp 193
2. Lockwood T. (2010) Design Thinking: Integrating Innovation, Customer Experience, and Brand Value. Allworth Press.
3. Osterwalder A., Pigneur Y. (2010) Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons, Ltd.

Periodicals and other sources:

1. Law of The Republic of Uzbekistan On Innovative Activity. (approved by Senate on June 19, 2020) https://lex.uz/docs/5155423
2. LLU Science and innovation: https://www.llu.lv/en/science-innovations
3. Web of science- abstract and citation database: https://www.webofscience.com/wos/woscc/basic-search
4. Scopus - abstract and citation database: https://www.scopus.com/search/form.uri?display=basic#basic
5. Biomimicry institute. Nature inspired innovation: https://biomimicry.org/
6. BLOOM Outreach & Engagement Guidebook https://bloom-bioeconomy.eu/repository/bloom-outreach-engagement-guidebook/
7. Most interesting companies in the Circular economy in Finland 2.1, SITRA: There are error with this address: https://www.sitra.fi/en/projects/interesting-companies-circular-economy-finland/#what-is-it-about

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