MODULE SPECIFICATION

Originating Institution, Department	Module Co-ordinator(s)
Kaliningrad State Technical University, Department of Electrical Equipment of Ships and Electrical Power Engineering	Prof. Dr. Habil Valeriy Beley

TITLE OF THE MODULE

Title of the module	Module code[1]
Organization and methodology of scientific research	Б1.О.04.02

PROGRAMME(S) IN WHICH TO BE OFFERED:

13.04.02 «Power and Electrical Engineering»

LEVEL OF STUDIES[2]

First cycle (BSc/BA) ☐	Second cycle (MSc/MA) ☒	Third cycle (PhD) ☐

CREDITS AND LEARNING HOURS

Credit Value[3]	ECTS Value[4]	Indicative academic learning hours[5]	Length (in Semesters)[6]	Year in which to be offered
3	-	108	1	1

ANNOTATION OF THE MODULE[7]

The course introduces methods and resources to conduct scientific research in the electric power industry and electrical engineering including the aspects of consumer behaviour relevant to

[1] To be indicated by the Institution
[2] According to the Framework of Qualifications for the European Higher Education Area, Annex 8: http://www.aic.lv/ace/ace_disk/Bologna/Bergen_conf/Reports/EQFreport.pdf
[3] Permissible credit values as set out in Institution's Academic Regulations
[4] European Credit Transfer System, 1 ECTS = 25-30 academic learning hours. Please refer to ECTS Users' Guide: https://ec.europa.eu/education/ects/users-guide/docs/ects-users-guide_en.pdf
[5] 1 academic learning hour is equal to 45 minutes
[6] Indicate 0.5, 1, 1.5 or 2
[7] Please provide brief summary of the module, up to 200 words

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energy efficiency and climate change. The course is dealing with methods to organize, plan and conduct experimental and analytical research as well as methods to obtain, gather and analyze the results and scientific information.
The module focuses international case studies and best practices. The theory and methodology of the subject is learned, and certain specific and general skills are developed at the BECK Simulated Big Data Interuniversity Networked Affective Educational Centre by using computer learning systems, big data mining, an affective tutoring system, e-sources and the Moodle Virtual Learning Environment.

AIM OF THE MODULE[8]

Aims of Module:

- To form the knowledge about science, objects of scientific research in the electric power industry and electrical engineering.
- To outline a range of theoretical and experimental research methods for solving scientific problems in the electric power industry and electrical engineering, including consumer behavior in relation to energy efficiency and climate change.
- To form the skills of independent planning, conducting and explaining the research in the field of power engineering and sustainable development in terms of energy efficiency, environmental impact, safety, reliability and consumer behaviour.
- To introduce complete ideas about the results of research and their presentation in the form of scientific paper

MOOC LEARNING AND TEACHING STRATEGIES

The MOOC course has to contribute to an opening up of education to the benefit of both learners and the society at large while reflecting values such as equity, quality and diversity. The common features of the course are:

- Openness to learners: open entry (no formal pre-requisites), freedom to study at the time, place and pace of your choice, flexible pathways, fit for a wide variety of lifelong learners;
- Digital openness: courses available online;
- Learner-centred approach: courses aid students to construct their own learning from a rich environment, and to share and communicate it with others;
- Independent learning: a MOOC provides high quality materials to enable the progress of an independent learner through self-study;
- Media-supported interaction: course materials make best use of online affordances (interactivity, communication, collaboration) as well as rich media (video and audio) to engage students with their learning.
- Recognition options: successful course completion will be recognised as indicating worthwhile educational achievement.
- Quality focus: focus on quality in the production and presentation of a MOOC.
- Spectrum of diversity: the course is inclusive and accessible to very diverse citizens.

The delivery of the new certificated and recognized adaptive BECK MOOCs is enabled by the use of the innovative Simulated Big Data Interuniversity Networked Affective Educational Centre. Affective computing technologies and neuro decision matrices, big data and text analytics, and an

[8] Aim of the module must correspond to the BECK Capacity Building Framework

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adapted Yerkes–Dodson law are the foundation of the BECK system. Affective computing is the study and development of systems and devices that can recognize, interpret, process and simulate human affects. The BECK system will interpret the emotional state of a student and adapt the learning process to that particular student by providing an appropriate response to relevant emotions and requirements.

Six major components have been identified for the development of the Simulated Big Data Interuniversity Networked Affective Educational Centre (the BECK Centre):

1) Adaptive MOOCs;
2) Computer learning systems;
3) Big Data Mining;
4) Affective Tutoring System;
5) Access to e-sources;
6) Moodle Virtual Learning Environment.

The computer learning system is understood as an object (with its components) for managing and investigating data, information, and expressed and unexpressed knowledge. It is a modelling system that accumulates data and information from various resources and then processes that data and information by means of various mathematical, logical and informational models.

The data mining will enable integrated analysis of the following data and information from multiple locations: weather, climate, dwelling envelope, utilities, occupancy, market data (government data, trade association data, financial data from major players, customer surveys), climate change, best practices, human influences, the behaviour of users, etc.

The Affective Tutoring System integrates the student self-assessment procedures with biometric (facial expression analysis) and intelligent techniques and technologies.

The centre will offer open-source videos, simulators (calculators and software), case studies from the best universities around the world to enhance the module.

The following main features have been identified for the development of the Moodle Virtual Learning Environment: adaptable design, modern and easy to use interface, personalized dashboard, collaborative tools and activities (Assignments, Chat, Choice, Database, Feedback, Forum, Glossary, Lesson, Quiz, Survey, Wiki, Workshop), all-in-one calendar, convenient file management, simple and intuitive text editor, notifications, progress track, secure authentication and mass enrolment, multilingual capability, high interoperability, user role and permission management, etc.

MOOC is accessible for various target groups. Its activities aid participants to construct their own learning and communicate it to others. The activities, tasks and routes are designed in such a way that they can be performed at specific levels of difficulty or complexity, to accommodate the broad spectrum of participants' knowledge and skills that is expected. The course contains sufficient interactivity (learner to content, learner to learner and learner to teacher) to encourage active engagement. The feedback of the academic tutor is limited and scalable. The course provides learners with regular feedback through self-assessment activities, tests or peer feedback. The MOOC has possibilities to follow the score and progression.

The pedagogical model of the course is such that the efforts of all services do not increase significantly as the number of participants increases. All aspects of the course are delivered online. Learning outcomes are assessed using the balance of formative and summative assessment appropriate to the level of certification.

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INTENDED LEARNING OUTCOMES AND ASSESSMENT

Learning Outcomes of the module[9]	***Methods of studies***	***Assessment methods of student achievements[10]***	***Assessment criteria of student achievements by assessment levels***
O1. Able to explain and apply the methodology of scientific research in relation to consumer behaviour relevant to energy efficiency and climate change	Blended learning, integrated affective tutoring and affective computing methods. The Integrated Method includes computer learning systems, big data mining, an affective tutoring system, access to e-sources (open-source videos, simulators such as calculators and software, and case studies from the best universities around the world), self-study in the Moodle Virtual Environment (learning materials including audiovisual materials, text materials, online interactions in forums to build a learning community, and exercises with an integrated feedback mechanism), live events (video conferencing)	☒ Problematic questions ☒ Intelligent tests ☐ Regular tests ☒ Problematic tasks ☐ Projects ☒ Peer evaluation ☐ Automated feedback ☐ Final evaluation ☒ Other: assessment of a written individual project work	*Threshold achievement level* Knows the concepts, theories and perspectives of the methodology of scientific research in relation to consumer behaviour relevant to energy efficiency and climate change, but is not able to explain and apply in a wider context *Typical achievement level* Able to explain and apply the concepts, theories and perspectives of the methodology of scientific research in relation to consumer behaviour relevant to energy efficiency and climate change *Excellent achievement level* Able to explain and apply the concepts, theories and perspectives of the methodology of scientific research in relation to consumer behaviour relevant to energy efficiency and climate change in a wider context
		☒ Problematic questions	*Threshold achievement level*

[9] Learning outcomes are specified in three categories – as **knowledge, skills and competence**. This signals that qualifications – in different combinations – capture a broad scope of learning outcomes, including theoretical knowledge, practical and technical skills, and social competences where the ability to work with others will be crucial. Please refer to Cedefop (2017). Defining, writing and applying learning outcomes: a European handbook. Luxembourg: Publications Office of the European Union. https://www.cedefop.europa.eu/files/4156_en.pdf. Learning outcomes of the module must correspond to the BECK Capacity Building Framework.

[10] Please select from the list. Additional assessment methods may be added.

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O2. Able to integrate scientific knowledge from various disciplines in order to analyze energy and sustainability projects with regard to environmental impact, safety, reliability and consumer behavior	Blended learning, integrated affective tutoring and affective computing methods.	☐ Intelligent tests ☐ Regular tests ☒ Problematic tasks ☐ Projects ☒ Peer evaluation ☐ Automated feedback ☐ Final evaluation ☒ Other: assessment of a written individual project work	Has basic skills to integrate scientific knowledge from various disciplines in order to analyze energy and sustainability projects with regard to environmental impact, safety, reliability and consumer behavior (demand response)
			Typical achievement level Has intermediate skills to integrate scientific knowledge from various disciplines in order to analyze energy and sustainability projects with regard to environmental impact, safety, reliability and consumer behavior
			Excellent achievement level Has advanced skills to integrate scientific knowledge from various disciplines in order to analyze energy and sustainability projects with regard to environmental impact, safety, reliability and consumer behavior
O3. Able to communicate and organize scientific research work and make decisions in relation to consumer behaviour relevant to energy efficiency and climate change by using modern ICT technologies	Blended learning, integrated affective tutoring and affective computing methods.	☒ Problematic questions ☐ Intelligent tests ☐ Regular tests ☒ Problematic tasks ☐ Projects ☐ Peer evaluation ☒ Automated feedback ☐ Final evaluation ☒ Other: assessment of a written individual project work	*Threshold achievement level* *Able to communicate and organize scientific research work and make decisions in relation to consumer behaviour relevant to energy efficiency and climate change by using modern ICT technologies at a basic level*
			Typical achievement level *Able to communicate and organize scientific research work and make decisions in relation to consumer behaviour relevant to energy efficiency and climate change by using modern ICT technologies*
			Excellent achievement level

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			Able to communicate and organize scientific research work and make decisions in relation to consumer behaviour relevant to energy efficiency and climate change by using modern ICT technologies at an advanced level

MODULE MARK CALCULATION[11]:

Assessment components (in chronological order of submission/examination date)				
Type of assessment[12]	Weighting, %	Duration *(if exam)*	Word count *(if essay or similar):*	Component pass required[13]
Assessment of the degree of interaction and participation of the students	30%			Yes ☐ No ☒
Written Individual Project Report	50%		10 000	Yes ☒ No ☐
Online examination (test)	20%	20 minutes		Yes ☒ No ☐
Total:	100%			

SYLLABUS OUTLINE

No.	Topic[14]	Number of hours[15]
1.	Introduction to the module. Methodological foundations of scientific knowledge	4
2.	The main trends and prospects of development of power engineering and electrical engineering objects	4
3.	Economical, ecological, political and social aspects of energy and sustainability	8
4.	Scientific approach in calculation of key energy efficiency indicators for electrical energy generation, transmission and consumption	12

[11] Please list all components, sum must be equal to 100%. Note that successful course completion should be recognised as indicating worthwhile educational achievement.
[12] Please indicate in chronological order of submission date each assessment component by type, e.g. examination, home work, coursework, project
[13] Indicate Yes to specify the assessment component(s) to be passed in order to pass the module
[14] Please add as many topics as needed
[15] Includes self-learning, on-line conferences and consultations

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5.	Methods of experimental research in the electric power industry and electrical engineering	12
6.	Experimental data collection on consumer behavior and energy efficiency	16
7.	Design of experiments. Data representation and interpretation.	8
8.	Methods of analytical research in the electric power industry and electrical engineering	12
9.	Searching, accumulation and processing of scientific information on consumer behavior and energy efficiency	12
10.	Probabilistic and statistical methods in power industry and electrical engineering	12
11.	Selection of the scientific research area, its structure and planning	8
	Total:	**108**

LEARNING MATERIALS[16]

Core materials (up to 5 references):

1. WC Turner and Steve Doty: Energy Management Handbook, Seventh Edition, (Fairmont Press Inc., 2007)
2. Sumper Andreas and Baggini Angelo: Electrical Energy Efficiency: Technologies and Applications (John Wiley 2012)
3. Iliev, Iliya & Kaloyanov, Nikola & Gramatikov, Plamen & Terziev, Angel & Palov, Ivan & Stefanov, Stefan & Sirakov, Kiril & Kamburova, Veselka. (2012). Energy Efficiency and Energy Management Handbook.
4. Beley V. F. i dr. Spravochnik modulya: vozobnovlyaemye istochniki energii: spravochnoe izdanie //Kaliningrad: Izd-vo OOO «TESK. – 2015.

Supplementary materials (up to 10 references):

1. Ryzhkov I. B., Gotman A.L., Abdrakhmanov R.F. Osnovy nauchnykh issledovaniy i izobretatel'stva: ucheb. posobie. 2-e izd. Sankt-Peterburg. 2013. 224 s.
2. Gerasimov B.I. Osnovy nauchnykh issledovaniy: ucheb. posobie. Moskva. 2013. 272 s.
3. Sibikin, M.YU. Tekhnologiya energosberezheniya [Elektronnyj resurs] : uchebnik / M.YU. Sibikin, YU.D. Sibikin. - 4-e izd., pererab. i dop. - Moskva ; Berlin : Direkt-Media, 2014. - 352 s. (EBS «Universitetskaya biblioteka onlajn»).
4. Energy Efficiency: https://link.springer.com/journal/12053
5. Open Journal of Energy Efficiency: https://www.scirp.org/journal/ojee/
6. Energy and Buildings: https://www.journals.elsevier.com/energy-and-buildings

On-line resources[17]:

1. International Energy Association: https://www.iea.org/topics/energyefficiency/
2. European Council for an Energy Efficient Economy: https://www.eceee.org

[16] Courses should provide high quality materials to enable an independent learner to progress through self-study. Materials should make best use of online affordances (interactivity, communication, collaboration) as well as rich media (video and audio) to engage students with their learning.

[17] Please provide links

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3. The European Energy Efficiency Fund: https://www.eeef.eu/home.html
Other materials: Lecture materials available at the BECK Simulated Big Data Interuniversity Networked Affective Educational Centre.

REQUIRED IT RESOURCES[18]

No.	Software, manufacturer
1.	MS Word
2.	MS Excel
3.	MS Power Point
4.	Adobe Acrobat reader
5.	Mathcad

Date of completion of this version of Module Specification ……..

Date of approval by the Faculty: ……..…

[18] Please add as many software as needed for the course

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