

Integrating education with consumer behaviour relevant to energy efficiency and climate change at the Universities of Russia, Sri Lanka and Bangladesh (BECK)

MODULE SPECIFICATION

Originating Institution, Department	Module Co-ordinator(s)
Vilnius Gediminas Technical University, Department of Construction Management and Real Estate	Prof. Arturas Kaklauskas Dr. Ieva Ubarte

TITLE OF THE MODULE

Title of the module	Module code¹
Smart City and Analytics (with course project)	STVNM17224

PROGRAMME(S) IN WHICH TO BE OFFERED:

Real estate Management

LEVEL OF STUDIES²

First cycle (BSc/BA) <input type="checkbox"/>	Second cycle (MSc/MA) <input checked="" type="checkbox"/>	Third cycle (PhD) <input type="checkbox"/>
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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
6	6	160	1	1 (Masters)

ANNOTATION OF THE MODULE⁷

Introduction to principles of sustainable city development, metrics and performance indicators. Built environment data, innovation economy, urban infrastructure. Overview of sustainable smart

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

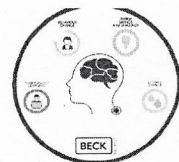
⁴ European Credit Transfer System, 1 ECTS = 25-30 academic learning hours. Please refer to ECTS Users' Guide: https://ec.europa.eu/education/ects/users-guide/docs/ects-users-guide_en.pdf

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





cities, smart systems theory, smart cities (context, policy, regulation and governance), built environment simulation and governance. e-Democracy and citizen city, Internet of things. Quantitative and qualitative methods, geographical information systems and science, spatial data theory and analytics. Energy efficient built environment, climate change, urban indicators for sustainable cities, quality of life. Managing natural resources and sustainable smart cities, green infrastructure and transportation, green buildings. Smart technologies for cities and buildings, tools for decision making, data, text and opinion mining. building information modelling, advanced visualisation and interactive technology. Introduction to the intelligent decision support systems, analysis of intelligent decision support systems in various smart cities fields

AIM OF THE MODULE⁸

To introduce students with smart cities and data mining, to discuss smart cities models, climate change, conduct smart cities systems analysis, to introduce students with various areas of smart cities activities, which provide intelligent decision support and affective computing.

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:

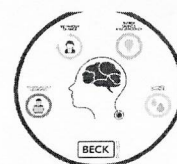
- Openness to learners: open entry (no formal pre-requisites), freedom to study at the time, place and pace of your choice, flexible pathways, fit for a wide variety of lifelong learners;
- Digital openness: courses available online;
- Learner-centred approach: courses aid students to construct their 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 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):

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





- 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.

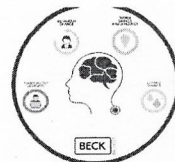
MOOC is accessible for various target groups. Its activities aid participants to construct their own learning and communicate it to others. The activities, tasks and routes are designed in such a way that they can be performed at specific levels of difficulty or complexity, to accommodate the broad spectrum 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.

INTENDED LEARNING OUTCOMES AND ASSESSMENT

<i>Learning Outcomes of the</i>	<i>Methods of studies</i>	<i>Assessment methods of</i>	<i>Assessments criteria of students achievements by assessment levels</i>
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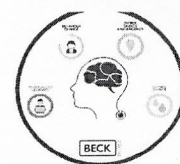


<i>module</i> ⁹		<i>student achievements</i> ¹⁰	
O1. Will understand the different interests of stakeholders in achieving energy efficient buildings.	Blended learning, integrated affective tutoring and affective computing methods. The Integrated Method include the computer learning systems, big data mining, affective tutoring system, access to e-sources (open-source videos, simulators (calculators and software), case studies from the best universities around the world), self-study in Moodle virtual environment (educational material including Video – audio material, Text material; Interaction in forums for building learning community; Exercises with integrated feedback mechanism); Live events (video conferencing)	<input checked="" type="checkbox"/> Problematic questions <input checked="" type="checkbox"/> Intelligent tests <input type="checkbox"/> Regular tests <input checked="" type="checkbox"/> Problematic tasks <input type="checkbox"/> Projects <input checked="" type="checkbox"/> Peer evaluation <input type="checkbox"/> Automated feedback <input type="checkbox"/> Final evaluation <input checked="" type="checkbox"/> Other: assessment of a written group essay	<i>Threshold achievement level</i> Knows the concepts, theories and perspectives of different stakeholders with regard to the green built environment, energy efficiency and climate change, but is not able to explain and apply in wider context
			<i>Typical achievement level</i> Able to explain and apply the concepts, theories and perspectives of different stakeholders with regard to the green built environment, energy efficiency and climate change.
			<i>Excellent achievement level</i> Able to explain and apply the concepts, theories and perspectives of different stakeholders with regard to the green built environment, energy efficiency and climate change in wider context
O2. Be able to argue their points of view and justify the decisions made.	Blended learning, integrated affective tutoring and affective computing methods.	<input checked="" type="checkbox"/> Problematic questions <input type="checkbox"/> Intelligent tests <input type="checkbox"/> Regular tests <input checked="" type="checkbox"/> Problematic tasks <input type="checkbox"/> Projects	<i>Threshold achievement level</i> Able to research and make decisions in the development of context-relevant solutions for the green built

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.

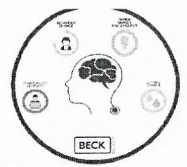
¹⁰ Please select from the list. Additional assessment methods may be added.





		<input type="checkbox"/> Peer evaluation <input checked="" type="checkbox"/> Automated feedback <input type="checkbox"/> Final evaluation <input type="checkbox"/> Other:	<p>environment in relation to energy efficiency and climate change by using modern ICT technologies at a basic level</p> <p><i>Typical achievement level</i> Able to research and make decisions in the development of context-relevant solutions for the green built environment in relation to energy efficiency and climate change by using modern ICT</p> <p><i>Excellent achievement level</i> Able to research and make decisions in the development of context-relevant solutions for the green built environment in relation to energy efficiency and climate change by using modern ICT at an advanced level</p>
<p>O3. Have gained near real-life experience in decision-making, communication and teamworking.</p>	<p>Interactive group work in developing context-relevant solutions.</p>	<input checked="" type="checkbox"/> Problematic questions <input type="checkbox"/> Intelligent tests <input type="checkbox"/> Regular tests <input checked="" type="checkbox"/> Problematic tasks <input type="checkbox"/> Projects <input checked="" type="checkbox"/> Peer evaluation <input type="checkbox"/> Automated feedback <input type="checkbox"/> Final evaluation <input checked="" type="checkbox"/> Other: activity assessment	<p><i>Threshold achievement level</i> Has basic skills to develop, communicate, manage and negotiate context-relevant solutions for the green built environment in relation to energy efficiency and climate change.</p> <p><i>Typical achievement level</i> Has intermediate skills to develop, communicate, manage and negotiate context-relevant solutions for the green built environment in relation to energy efficiency and climate change.</p> <p><i>Excellent achievement level</i> Has advanced skills to develop, communicate, manage and negotiate context-relevant solutions for the green built environment in relation to energy efficiency and climate change.</p>





MODULE MARK CALCULATION¹¹:

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
Mark for individual work	30%			Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Mark for test of 20 questions, the correct answer is equal to 0.5 points	70%			Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Total:	100%			

SYLLABUS OUTLINE

No.	Topic ¹⁴	Number of hours ¹⁵
1.	Introduction to principles of sustainable city development, metrics and performance indicators and climate change	10
2.	Built environment data, innovation economy, urban infrastructure	10
3.	Overview of sustainable smart cities, smart systems theory, smart cities (context, policy, regulation and governance), built environment simulation and governance	10
4.	e-Democracy and citizen city	10
5.	Internet of things	15
6.	Quantitative and qualitative methods	10
7.	Geographical information systems and science, spatial data theory and analytics	10
8.	Energy efficient built environment, climate change	10
9.	Urban indicators for sustainable cities, quality of life	15
10.	Managing natural resources and sustainable smart cities, green infrastructure and transportation, green buildings	15
11.	Smart technologies for cities and buildings, tools for decision making	15
12.	Data, text and opinion mining. Building information modelling. Advanced visualisation and interactive technology	15
13.	Introduction to the intelligent decision support systems. Analysis of intelligent decision support systems in various smart cities fields	15

¹¹ Please list all components, sum must be equal to 100%. Note that successful course completion should be recognised as indicating worthwhile educational achievement.

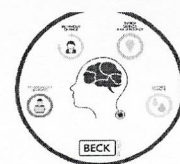
¹² Please indicate in chronological order of submission date each assessment component by type, e.g. examination, home work, coursework, project

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





Total:	160
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LEARNING MATERIALS¹⁶

Core materials (up to 5 references):

1. Kaklauskas A. Biometric and Intelligent Decision Making Support. Series: Intelligent Systems Reference Library, Vol. 81. 2015, XII. Springer-Verlag, Berlin, 228 p.
2. A. Kaklauskas. Analysis of the Life Cycle of a Built Environment: Monograph. Nova: USA, 2016. 270 p.
3. Ark, T. V. 2014. Smart Cities that Work for Everyone: 7 Keys to Education & Employment. Getting Smart, 280 p.
4. Batty, M. 2013. The New Science of Cities. The MIT Press, 520 p.
5. Deakin, M. 2013. Smart Cities: Governing, Modelling and Analysing the Transition. Routledge: 1 edition, 248 p.

Supplementary materials (up to 10 references):

1. Etezadzadeh, C. 2016. Smart City – Future City?: Smart City 2.0 as a Livable City and Future Market (essentials). Springer Vieweg, 61 p.
2. Firodia, A., Pavnaskar, V., Murthy, N. 2015. Smart City: A Blueprint for a Zero Pollution, Sustainable, Smart Industrial City. Vishwakarma Publications: 1 edition, 131 p.
3. Goldsmith, S., Crawford, S. 2014. The Responsive City: Engaging Communities Through Data-Smart Governance. Jossey-Bass: 1 edition, 208 p.
4. Obaidat, M. S., Nicopolitidis, P. 2015. Smart Cities and Homes: Key Enabling Technologies. Morgan Kaufmann: 1 edition, 452 p.
5. Ratti, C., Claudel, M. 2016. The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life (The Future Series). Yale University Press, 192 p.
6. Sashinskaya, M. 2015. Smart Cities in Europe: Open Data in a Smart Mobility context. CreateSpace Independent Publishing Platform, 146 p.
7. Shark, A. R., Toporkoff, S., Levy, S. 2014. Smart Cities for a Bright Sustainable Future - A Global Perspective. CreateSpace Independent Publishing Platform, 376 p.
8. Stimmel, C. L. 2015. Building Smart Cities: Analytics, ICT, and Design Thinking. Auerbach Publications, 290 p.
9. Townsend, A. M. 2014. Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia. W. W. Norton & Company: 1 edition, 416 p.

On-line resources¹⁷:

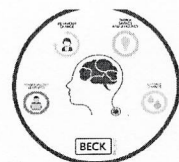
MSC students can use different real estate investment and development computer learning systems developed by module's author in conjunction with his colleagues appeared in reviewed publications containing the Web of Science Core Collection citation index:

1. Crisis Thermometer for housing market recommendations (Kaklauskas et al. 2015)

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





2. Advisory, negotiation and intelligent decision support system for leadership analysis (Gudauskas et al. 2015)
3. Housing health and safety decision support system with augmented reality (Kaklauskas et al. 2015)
4. An affect-based, multimodal, video recommendation system (Kaklauskas et al. 2016)
5. Facilitating the housing bargaining with the help of the bargaining decision support system (Urbanavičienė et al. 2014)
6. Multiple-Criteria Analysis of Life Cycle of Energy-Efficient Built Environment (Kaklauskas et al. 2013)
7. Passive house model for quantitative and qualitative analyses and its intelligent system (Kaklauskas et al. 2012)
8. Web-based biometric computer mouse advisory system to analyze a user's emotions and work productivity (Kaklauskas et al. 2011)
9. Recommended biometric stress management system (Kaklauskas et al. 2011)
10. Planning Alternative Building Life Cycle Processes and Multi-criteria Analysis Decision-making Support System SPS (Zavadskas et al. 2005)
11. Planning Alternative, Information Grounded Building Renewal and Multi-criteria Analyses SPS (Kaklauskas et al. 2005a)
12. Internet Real Estate Intelligent SPS (Kaklauskas et al. 2005b)
13. Planning of Alternative, Information and Device Grounded Building Renewal and Multi-criteria Analyses SPS (Zavadskas et al. 2006)
14. Internet, multi-criteria, decision-making support system in construction (Kaklauskas et al. 2007)
15. Multi-criteria Analyses of Innovations SPS (Kaklauskas, Zavadskas 2007)
16. Planning Alternative Building Management and Multi-criteria Analysis System (Lepkova et al. 2008)
17. Pledged Intelligent Environment SPS (Kaklauskas et al. 2010b)
18. Crisis Management in the Construction and Real Estate Sector SPS (Kaklauskas et al. 2011)
19. Negotiations System (Urbanaviciene et al. 2009)
20. Energetics Systems Multi-criterion SPS (Sliogerienė et al. 2009)
21. Facilities management Analysis SPS (Lepkova et al. 2008)
22. Pledged and Humanized Environmental Renewal SPS (Tupenaite et al. 2010)

<http://iti.vgtu.lt/tempus/>

<http://smartvideo.dev.vgtu.lt/site/login>

<http://iti3.vgtu.lt/ilearning/zemelapis.aspx>

<http://iti.vgtu.lt/realestate/>

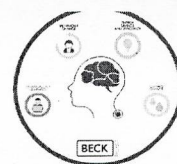
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<http://iti3.vgtu.lt/savas/simpletable.aspx?sistemid=1936>
<http://iti3.vgtu.lt/savas/simpletable.aspx?sistemid=211>

Other materials:

Lecture materials available at the BECK Simulated Big Data Interuniversity Networked Affective Educational Centre.

REQUIRED IT RESOURCES¹⁸

No.	Software, manufacturer
1.	MS Excel
2.	Adobe Acrobat reader

Date of completion of this version of Module Specification

Date of approval by the Academic Support Center

Vaidotas Trinkūnas

 2020 06 22

¹⁸ Please add as many software as needed for the course

