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)
University of Moratuwa Department of Civil Engineering	Prof. R.U. Halwatura

TITLE OF THE MODULE

Title of the module	Module code[1]
Sustainable design and whole lifecycle	**CE 4610**

PROGRAMME(S) IN WHICH TO BE OFFERED:

Bachelor of Civil 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	6	150	0.5	4th Year

* European Credit Transfer and Accumulation System (ECTS), 1 credit in Sri Lanka equals 2 in ECTS
* Sri Lanka Qualifications Framework (SLQF) 1 Credit equals 50 notional learning hours
* The notional learning hours include direct contact hours with teachers and trainers, time spent in self-learning, preparation for assignments, carrying out assignments and assessments.

[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

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ANNOTATION OF THE MODULE[7]

The course sustainable design and whole life cycle provides an insightful and holistic understanding on whole life cycle and improve the decision making ability with respect to environmental conservation attributed with scientific methodologies and research findings.
The concepts of sustainability and sustainable development are introduced, interpret sustainability at local paradigm is discussed, various dimensions of sustainability are addressed by surveying current laws, regulations and standards. Effects of non-sustainability on the developed, developing and underdeveloped nations are discussed and engineering challenges specific to each are identified through international case studies. Stages of whole life cycle are interpreted and sustainable designs are promoted through life cycle assessment (LCA) applications. 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]

This module aims to develop understanding on whole life cycle and to improve the decision making ability with respect to environmental conservation.

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.

[7] Please provide brief summary of the module, up to 200 words
[8] Aim of the module must correspond to the BECK Capacity Building Framework

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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):

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), and 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 participant increases. All aspects of the course are delivered online.

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Learning outcomes are assessed using the balance of formative and summative assessment appropriate to the level of certification.

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. Appraise the holistic understanding of the sustainability and impact of our lifestyle on climate change. (Ex: choices of products, transportation methods or personal outlooks and beliefs.)	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: In video quiz (e-testing) ☒ Other: Forum discussions (e-testing)	*Typical achievement level (Achieving the medium order thinking skills in Bloom's Taxonomy)* After completion of this module, students will be able to appraise the holistic understanding of the sustainability and impact of our lifestyle on climate change.
O2. Evaluate sustainable concepts, solutions and the interconnections between them on all scales.	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: In video quiz (e-testing) ☒ Other: Forum discussions (e-testing)	*Excellent achievement level (Achieving the higher order thinking skills in Bloom's Taxonomy)* After completion of this module, students will be able to evaluate sustainable concepts, solutions and the interconnections between them on all scales.

[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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O3. Discover creative approaches for a vast change in the whole lifecycle (Ex: product or a building)	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: In video quiz (e-testing) ☒ Other: Forum discussions (e-testing)	<u>*Excellent achievement level*</u> *(Achieving the higher order thinking skills in Bloom's Taxonomy)* After completion of this module, students will be able to discover creative approaches for a vast change in the whole lifecycle.
O4. Evaluate sustainability strategies to safeguard and/or enhance the brand value. (Ex: brand value of a product/building/company/ industry.)	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: Forum discussions (e-testing)	<u>*Excellent achievement level*</u> *(Achieving the higher order thinking skills in Bloom's Taxonomy)* After completion of this module, students will be able to Evaluate sustainability strategies to safeguard and/or enhance the brand value.

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 1. <u>Week 01-</u> ▪ In-video quiz ▪ Forum discussion	30%			Yes ☒ No ☐

[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

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2. <u>Week 02-</u> ▪ Forum discussion ▪ Coursework#01 3. <u>Week 03-</u> ▪ Forum discussion 4. <u>Week 04-</u> ▪ Forum discussion ▪ Coursework#02 5. <u>Week 05-</u> ▪ Forum discussion 6. <u>Week 06-</u> ▪ Project report (Group)#01 7. <u>Week 07-</u> ▪ Forum discussion ▪ Quiz 8. <u>Week 08-</u> ▪ Forum discussion ▪ Coursework#03 9. <u>Week 09-</u> ▪ Forum discussion ▪ Online presentation (Group)#01 10. <u>Week 10-</u> ▪ Forum discussion ▪ Coursework#04 11. <u>Week 11-</u> ▪ Project report (Individual)#01 12. <u>Week 12-</u> ▪ Forum discussion 13. <u>Week 13-</u> ▪ Coursework#05 14. <u>Week 14-</u> ▪ Project report (individual)#02				
<u>Written reports</u> ▪ Project report (group)#01 ▪ Project report (individual)#01 ▪ Project report (individual)#02	50%		5000 for each report	Yes ☒ No ☐
Online examination (test)	20%	20 minutes		Yes ☒ No ☐
Total:	100%			

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SYLLABUS OUTLINE

No.	Topic[14]	Number of hours[15]
1.	The concepts of sustainable development and sustainability in its proper form. (Ex: Sustainability is more than just being 'green') • Definitions of sustainability and sustainable development • Triple bottom line approach of sustainability • Sustainable development goals • Sustainable development challenges	15
2.	Local interpretation of sustainability. • Multidisciplinary avenues of sustainability • Introducing Sustainability indicators • Application of sustainability indicators to monitor the progress of sustainable development • Sustainability and standards of living	20
3.	The current laws, regulations and standards that are being conceived and put in place to address the various dimensions of sustainability.	20
4.	Effects of non-sustainability on the developed, developing and underdeveloped nations and learn about the engineering challenges specific to each. • What do you mean by non sustainability • Non sustainability in different avenues • Unsustainable development • Developed, developing and underdeveloped nations • Challenges of non-sustainability in developed, developing and underdeveloped nations • Identification of engineering challenges specific to each category • Engineering solutions to overcome non-sustainability in developed, developing and underdeveloped nations	20
5.	Stages of a whole life cycle (ex: product or building) • Gate to gate • Cradle to gate • Cradle to grave • Cradle to Cradle	20
6.	Sustainable design promotion through life-cycle assessment (LCA) applications. • Environmental sustainability • Material phase sustainability • Manufacturing phase sustainability • Retail phase sustainability	25

[14] Please add as many topics as needed
[15] Includes self-learning, on-line conferences and consultations

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	• Use phase sustainability • Disposal phase sustainability	
7.	Sustainable Practices • Branding with sustainability • Green labelling and environmental management system • Ethical sourcing and purchasing • Employee and customer engagement in sustainable operations • Social stakeholders management • Legal issues on social responsibility	30
Total:		**150**

LEARNING MATERIALS[16]

Core materials (up to 5 references):

1. Kaklauskas, A. (2016). Analysis of the Life Cycle of a Built Environment: Monograph. Nova: USA, 2016. https://doi.org/10.3846/2325-M
2. Kaklauskas, A. (2015). Biometric and Intelligent Decision Making Support. Series: Intelligent Systems Reference Library, Vol. 81. 2015, XII. Springer-Verlag, Berlin. https://doi.org/10.1007/978-3-319-13659-2
3. Kaklauskas, A., Zavadskas, E. K., Bardauskienė, D., & Dargis, R. (Eds.). (2015). Sustainable Development of Real Estate. Vilnius: Technika. https://doi.org/10.3846/2336-M
4. Lahlou, S. (Ed.). (2011). System Innovation for Sustainability 4: Case Studies in Sustainable Consumption and Production — Energy Use and the Built Environment (1st Ed.). Routledge.
5. Williamson, K., Satre-Meloy, A., Velasco, K., & Green, K. (2018). Climate Change Needs Behavior Change: Making the Case for Behavioral Solutions to Reduce Global Warming. Arlington, VA: Rare.

Supplementary materials (up to 10 references):

1. Peterlin, J., Dimovski, V., Tvaronavičienė, M., Grah, B., Kaklauskas, A. (2018). The strategic process of developing social aspects of sustainability through the vision reflection in business education. Technological and economic development of economy, 24(4), 1718-1736. https://doi.org/10.3846/tede.2018.5198
2. Kaklauskas, A.; Herrera-Viedma, E., Echenique, V., Zavadskas, E. K., Ubarte, I., Mostert, A., Podvezko, V., Binkyte, A., & Podviezko, A. (2018). Multiple criteria analysis of environmental sustainability and quality of life in post-Soviet states. Ecological Indicators, 89, 781-807. https://doi.org/10.1016/j.ecolind.2017.12.070
3. Kaklauskas, A., Zavadskas, E. K., Radzevičienė, A., Ubartė, I., Podviezko, A., Podvezko, V., Kuzminskė, A., Banaitis, A., Binkytė, A., & Bučinskas, V. (2018). Quality of city life multiple criteria analysis. Cities. Oxford: Elsevier. 72, Part A, 82-93. https://doi.org/10.1016/j.cities.2017.08.002

[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.

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4. Niemi, R., Mikkola, J., & Lund P. D. (2012). Urban energy systems with smart multi-carrier energy networks and renewable energy generation. Renewable Energy, 48, 524-536. https://doi.org/10.1016/j.renene.2012.05.017
5. Wells, V. K., Ponting, C. A., & Peattie, K. (2011). Behaviour and climate change: Consumer perceptions of responsibility. Journal of Marketing Management, 808-833. https://doi.org/10.1080/0267257X.2010.500136
6. de Guttry, C., Süsser, D., & Döring, M. (2019). Situating climate change: Psychological distances as tool to understand the multifaceted dimensions of climate change meanings. Geoforum, 104, 92-100. https://doi.org/10.1016/j.geoforum.2019.06.015
7. Andrić, I., Koc., M., & Al-Ghamdi, S. G. (2019). A review of climate change implications for built environment: Impacts, mitigation measures and associated challenges in developed and developing countries. Journal of Cleaner Production, 211, 83-102. https://doi.org/10.1016/j.jclepro.2018.11.128
8. Chatterton, T., & Department of Energy and Climate Change. (2011). An introduction to thinking about 'energy behaviour': A multi-model approach. Department of Energy and Climate Change, London. Available at: https://uwe-repository.worktribe.com/output/957138

On-line resources[17]:

1. Climate Action Tracker: https://climateactiontracker.org/
2. Green Growth Knowledge Platform: https://www.greengrowthknowledge.org/theme/climate-change
3. Climate Change & Resilience Information Centre: https://careclimatechange.org/
4. Climate ADAPT: https://climate-adapt.eea.europa.eu

Other materials:

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

REQUIRED IT RESOURCES[18]

No.	Software, manufacturer
1.	Word, Microsoft
2.	Excel, Microsoft
3.	Power Point, Microsoft
4.	Adobe Acrobat reader
5.	AutoCAD, AutoDesk
6.	Zoom
7.	Prezi

Date of completion of this version of Module Specification 19-05-2021

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

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