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)
Department of Agricultural Engineering, Faculty of Agriculture, University of Ruhuna	Prof. Champa Navaratne

TITLE OF THE MODULE

Title of the module	Module code[1]
Climate change at urban and peri-urban scale in tropics : Impacts, Mitigation and adaptation	

PROGRAMME(S) IN WHICH TO BE OFFERED:

Urban and peri-urban agriculture as a strategy to meet challenges of the climate change Water management techniques to meet the challenges of climate change

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
03	03	84	01	01

[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]

Climate change will have many ecological, social and economic impacts. The impacts of climate change are mainly affected for the ecosystems. Water management is one of the major concept in mitigation and adaption of challenges in climate change. Understanding of the links between climate change, water and society demands integration and synthesis of information regarding hydrologic, atmospheric and socioeconomic systems, and the ability to evaluate different approaches to mitigation and adaptation.

The course introduces a holistic view to address climate change, mitigation and adaptation aligning with urban and peri-urban agriculture (UPA). The course discusses heat island effect, urban and peri-urban planning and designing strategies along with green tools such as green roofs, green walls and green belts. This focuses the potential of urban and peri-urban agriculture to assure the food security of urban and peri-urban areas with combining of hydroponic techniques and organic farming. The course integrates climate smart agriculture and neural networking for the achieving of sustainable development goals through urban and peri-urban agriculture

In this course a global perspective will adopt to understand the diversity of impacts and responses to climate change and water resources management. The course will also focus on the identification of adaptation measures in water management with particular emphasis on various climate change scenarios. The different water management technologies (conventional and novel) introduce to mitigate climate change challenges in agriculture and urban sector. Irrigation and water management, urban drainage design and management, rain water harvesting, ground water management and climate change, climate smart technologies in climate change, weather modelling and forecasting and integrated water management systems will be discussed under this course.

AIM OF THE MODULE[8]

Aim of the course is to provide students with an understanding of the basic principles and knowledge for the planning, design and implementation of various water management and modern concepts of urban and peri urban agriculture techniques to mitigate and adaption of challenges in climate change.

MOOC LEARNING AND TEACHING STRATEGIES

A massive open online course (MOOC) is a model for delivering learning content online to any person who wants to take a course, with no limit on attendance. With learners today earning more substantive credentials and, in some cases, academic credits through MOOCs, the authors designed a study to investigate the benefits and costs to learners who are engaging in a series of open, online courses that provide a culminating nondegree credential.

MOOCs generally have the following features;

- Massive - enrolments are unlimited and can run into hundreds of thousands

[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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- Open Access - not requiring a test of prior knowledge before starting the course.
- Open - do not require payment just for access to content and peers.
- Online - online web delivery. Contents may be in multiple modes - video, audio, text and animation.

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), 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

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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

Learning Outcomes of the module[9]	***Methods of studies***	***Assessment methods of student achievements[10]***	***Assessment criteria of student achievements by assessment levels***
1. To identify and describe importance and impacts of water management in climate change challenges in urban and periurban agricultural sector.	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 audio-visual materials, text materials, online interactions in	☒ Online quizzes ☐ Intelligent tests ☒ Regular tests ☒ Problematic tasks ☐ Projects ☒ Peer evaluation ☐ Automated feedback ☒ Final evaluation ☒ Report writing ☐ written group essay	*Threshold achievement level* Able to Identify and understanding the importance and impacts of water management in climate change challenges in urban and peri urban agricultural sector. *Typical achievement level* Able to describe importance and impacts of water management in climate change challenges in urban and peri urban agriculture sectotr. *Excellent achievement level* Able to describe importance and impacts of water management in climate change challenges in urban and peri urban agriculture sectotr in wider context.

[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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	forums to build a learning community, and exercises with an integrated feedback mechanism), live events (video conferencing)		
O2. To discuss different water management techniques to mitigate and adapt on climate change impacts in urban and peri urban area.	Blended learning, integrated affective tutoring and affective computing methods.	☐ Problematic questions ☒ Online quizzes ☒ Regular tests ☒ Problematic tasks ☐ Projects ☒ Peer evaluation ☐ Automated feedback ☒ Final examination ☒ Assignment (Report writing) ☐ Individual presentation making	*Threshold achievement level* Able to know different water management techniques to mitigate and adapt on climate change impacts in urban and peri urban area at a basic level. *Typical achievement level* Able to discuss different water management techniques to mitigate and adapt on climate change impacts in urban and peri urban area. *Excellent achievement level* Able to discuss different water management techniques to mitigate and adapt on climate change impacts in urban and peri urban area in wider context.
O3. To identify, formulate and analyse management problems in a given water management System to mitigate and adaption to climate change by using different water management techniques.	Blended learning, integrated affective tutoring and affective computing methods.	☒ Problematic questions ☒ online quizzes ☒ Regular tests ☐ Problematic tasks ☒ Projects/case study ☒ Peer evaluation ☐ Automated feedback ☒ Final examination ☒ Other: activity assessment ☒ Group essay writing ☒ video making	*Threshold achievement level* To identify, formulate and analyse management problems in a given water management System to mitigate and adaption to climate change by using different water management techniques at a basic level. *Typical achievement level* Able to formulate management problems in a given water management System to mitigate and adaption to climate change by using different water management techniques.

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			Excellent achievement level Able to identify, formulate and analyse management problems in a given water management System to mitigate and adaption to climate change by using different water management techniques in real scenarios.
O4. Able to identify concepts, theories and perspectives of urban and peri-urban agriculture in relation to climate change relevant to adaptation and mitigation	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) self-study in the Moodle Virtual Environment (learning materials including audio visual materials, text materials, online interactions in forums to build a learning community, and exercises with an integrated feedback mechanism)	☒ Online Quizes ☐ Intelligent tests ☒ Regular tests ☒ Problematic tasks ☐ Projects ☒ Peer evaluation ☐ Automated feedback ☒ Final evaluation ☒ Individual presentation	*Threshold achievement level* Knows the concepts, theories and perspectives of urban and peri-urban agriculture in relation to climate change relevant to adaptation and mitigation
			Typical achievement level Able to explicate concepts, theories and perspectives of urban and peri-urban agriculture in relation to climate change relevant to adaptation and mitigation
			Excellent achievement level Able to manifest and apply the concepts, theories and perspectives of urban and peri-urban agriculture in relation to climate change relevant to adaptation and mitigation in a wider context
O5. Able to research and make decisions in the development of urban and peri-urban agriculture in relation to climate change relevant to adaptation and mitigation by using climate smart agriculture		☒ Online Quizes ☐ Intelligent tests ☒ Regular tests ☒ Problematic tasks ☐ Projects ☒ Peer evaluation ☐ Automated feedback ☒ Final evaluation ☐ Individual presentation	*Threshold achievement level* Able to research and make decisions in the development of urban and peri-agriculture in relation to climate change relevant to adaptation and mitigation by using climate smart agriculture and neural networking with the aid of modern ICT technologies at a basic level
			Typical achievement level

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and neural networking with the aid of modern ICT technologies			Able to research and make decisions in the development of urban and peri-agriculture in relation to climate change relevant to adaptation and mitigation by using climate smart agriculture and neural networking with the aid of modern ICT technologies
			Excellent achievement level Able to research and make decisions in the development of urban and peri-agriculture in relation to climate change relevant to adaptation and mitigation by climate smart agriculture and neural networking with the aid of using modern ICT technologies at an advanced level

MODULE MARK CALCULATION[11]:

Urban and peri-urban agriculture as a strategy to meet challenges of the climate change

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]
Assignments (include online tests)	30%			Yes ☐ No ☒
Mid semester examination	20%	30 min		Yes ☒ No ☐
End semester examination	50%	1 hr		Yes ☒ No ☐
Total:	100%			

Water management techniques to meet the challenges of climate change

Assessment components (in chronological order of submission/examination date)

[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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Type of assessment[14]	Weighting, %	Duration *(if exam)*	Word count *(if essay or similar):*	Component pass required[15]
Assessment of the degree of interaction and participation of the students	10%			Yes ☐ No ☒
Regular written Test (Mid-Term, Assessment, Quizzes)	20%	20 minutes		Yes ☒ No ☐
Assignments, Laboratory Reports and Group Works	30%			Yes ☒ No ☐
End Examination	40%	60 minutes		Yes ☒ No ☐
Total:	100%			

SYLLABUS OUTLINE

No.	**Topic[16]**	**Number of hours[17]**
Water management techniques to meet the challenges of climate change		
1.	Introduction to climate change adaption in urban and peri-urban agriculture and water management	6
2.	Sustainable water management techniques in urban agriculture for climate change adaption	6
3.	Urban drainage design and management, rain water harvesting, ground water management in climate change mitigation and adaptation processes	6
4.	Climate smart technologies for water management to meet climate challenges	3
5.	Weather modelling and forecasting for climate change adaption	2
6.	Integrated water management practices and climate change in urban agriculture	2
7.	Threats and opportunities in the water management techniques in climate change adaption in urban and semi urban area.	2
Urban and peri-urban agriculture as a strategy to meet challenges of the climate change		
8.	Population growth, Urbanization and Adapting to climate change in urban and peri urban areas	4
9.	Heat island effect and urban & peri urban planning	4

[14] Please indicate in chronological order of submission date each assessment component by type, e.g. examination, home work, coursework, project
[15] Indicate Yes to specify the assessment component(s) to be passed in order to pass the module
[16] Please add as many topics as needed
[17] Includes self-learning, on-line conferences and consultations

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10.	Tools for urban & peri urban designing and strategies for implementation	7
11.	Integrating urban & peri urban agriculture (UPA) for Community Food Security Coalition (CFSC)	8
12.	Urban and UPA to improve micro climate and waste recycling	6
13.	Hydroponic techniques and organic farming strategies for urban and peri urban areas	10
14.	Integrating climate smart agriculture and neural networking to achieve sustainable development goals (SDGs) through urban and peri urban agriculture	7
15.	Improving life satisfaction, preserve cultural identity and tradition through urban and UPA	5
	Total	**84**

LEARNING MATERIALS[18]

Core materials (up to 5 references):

1. Craig, C., Rick, E., Susan, H., Rafik, H., Gabrielle, P., & Carolina, P. (2010). Water Working Notes adaptation options. In Water working notes. Water Sector Board of the Sustainable Development Network of the World Bank Group.
2. DHI, (2016), Urban climate change guidelines, How to achieve sustainable adaptation in urban areas. https://www.dhigroup.com/areas-of-expertise/climate-change/urban-water-and-climate-change
3. Francesco, T., Josef, S., Mark, H., Peter, G. N., Sarah, P., Erick, F., & Dipti, T. (2008). Climate Change Response Strategies for Agriculture: Challenges and Opportunities for the 21st Century. Agriculture and Rural Development. Retrieved from http://www.worldbank.org/rural
4. Wilk, J. and Wittgren, H.B. (eds). Adapting Water Management to Climate Change. Swedish Water House policy Brief nr. 7. SIWI, 2009.
5. Pauw, P. and M. Francesch-Huidobro. 2010. 'Hong Kong', Connecting Delta Cities: Sharing Knowledge and Working on Adaptation to Climate Change. Rotterdam: City of Rotterdam.
   Vermeulen, S.J., Aggarwal, P.K., Ainslie, A., Angelone, C., Campbell, B.M., Challinor, A.J., Hansen, J.W., Ingram, J.S.I., Jarvis, A., Kristjanson, P. and Lau, C., 2012. Options for support to agriculture and food security under climate change. *Environmental Science & Policy*, *15*(1), pp.136-144.
6. Appeaning Addo, K., 2010. Urban and peri-urban agriculture in developing countries studied using remote sensing and in situ methods. *Remote Sensing*, *2*(2), pp.497-513.
7. Merson, J., Attwater, R., Ampt, P., Wildman, H. and Chapple, R., 2010. The challenges to urban agriculture in the Sydney basin and lower Blue Mountains region of Australia. *International Journal of Agricultural Sustainability*, *8*(1-2), pp.72-85.

Supplementary materials (up to 10 references):

[18] 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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1. Charles, B., & Julian, S. (2018). Compendium on Climate-Smart Irrigation. Retrieved from Global Alliance for Climate-Smart Agriculture website: http://www.fao.org/3/CA1726EN/ca1726en.pdf
2. Grace Tjandraatmadja. 2019. The Role of Policy and Regulation in WSUD Implementation. Approaches to Water Sensitive Urban Design, pages 87-117.
3. Hoanh, Chu Thai; Johnston, Robyn; Smakhtin, Vladimir. 2015. Climate change and agricultural water management in developing countries. Wallingford, UK: CABI. 227p. (CABI Climate Change Series 8)
4. Sander, B. O.; Wassmann, R.; Siopongco, J. D. L. C. 2015. Mitigating greenhouse gas emissions from rice production through water-saving techniques: potential, adoption and empirical evidence. In Hoanh, Chu Thai; Johnston, Robyn; Smakhtin, Vladimir. Climate change and agricultural water management in developing countries. Wallingford, UK: CABI. pp.193-207. (CABI Climate Change Series 8)
5. UNEP,2017, Climate Change Adaptation Technologies For Water. http://www.unepdhi.org › media › microsite_unepdhi › publications › documents
6. Fussel, H. and R.T. Klein. 2006. Climate change vulnerability assessments: An evolution of conceptual thinking. Climatic Change 75:301-329. http://startinternational.org/library/archive/files/ussel-climate-ch-2006 3_bfe07607d5.pdf
7. Armar-Klemesu, M., 2000. Urban agriculture and food security, nutrition and health. Growing cities, growing food. Urban agriculture on the policy agenda, pp.99-118.
8. de Zeeuw, H. and Drechsel, P. eds., 2015. Cities and agriculture: Developing resilient urban food systems. Routledge.
9. Hoornweg,D.and Munro-Faure,P.,2008.Urban agriculture for sustainable poverty alleviation and food security.Position paper,FAO.Africa.
10. Si, Z., Marshman, J., Berge, S., Dai, N., Soma, T., Dale, B., Landman, K., Bacher, J., Rahman, M. and Levkoe, C.Z., 2016. Cities and Agriculture: Developing Resilient Urban Food Systems by Henk de Zeeuw and Pay Drechsel (Eds.). Canadian Food Studies/La Revue canadienne des études sur l'alimentation, 3(2), pp.216-230.

On-line resources[19]:

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
5. Climate Action Tracker: https://climateactiontracker.org/
6. Green Growth Knowledge Platform: https://www.greengrowthknowledge.org/theme/climate-change
7. Climate Change & Resilience Information Centre: https://careclimatechange.org/
8. Climate ADAPT: https://climate-adapt.eea.europa.eu

Other materials:

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

[19] Please provide links

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REQUIRED IT RESOURCES[20]

No.	Software, manufacturer
1.	MS Office Packages(Word, PowerPoint and Excel)
2.	Adobe Acrobat reader
3.	Crop WAT software
4.	Envi-met 4.4

Date of completion of this version of Module Specification: 06/ 11/ 2019

Date of approval by the Faculty: 08/ 11/ 2019

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

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