Sveučilište u Zagrebu Agronomski fakultet
Svetošimunska cesta 25, 10000 Zagreb
Telefon: +385 (0)1 2393 777
E-mail: dekanat@agr.hr
Web: www.agr.unizg.hr

Renewable energy for rural areas (169515)

Nositelj kolegija

izv. prof. dr. sc. Vanja Jurišić

Opis kolegija

The main objective of this course is to provide knowledge regarding renewable energy sources (RES), and the potential of their integration in agricultural production. Production models and utilization of different types of RES, together with their impact on agricultural production will be discussed. Moreover, potential production of biomass and biofuels from agricultural production will also be discussed in details, with emphasis on energy production through utilization of organic waste after agricultural and food production. All types of RES production will be discussed from the aspect of environmental protection, and EU and Republic of Croatia legislatives and regulatives.

ECTS: **3.00**

Engleski jezik: **R1**

E-učenje: **R1**

Sati nastave: 30
Predavanja: 18
Auditorne vježbe: 4
Seminar: 4
Terenske vježbe: 4

Izvođač predavanja

- prof. dr. sc. Neven Voća

Ocjenjivanje

Dovoljan (2): 60%
Dobar (3): 70%
Vrlo dobar (4): 80%
Izvrstan (5): 90%

Vrsta kolegija

- Graduate studies / Environment, agriculture and resource management (Izborni kolegij, 4. semestar, 2. godina)

Opće kompetencije

1. Using different forms of renewable energy sources in agriculture
2. Understanding the basic processes in production of biomass and biofuels in agriculture
3. Understanding the concept of zero waste production in agriculture

Developed by Superfluo d.o.o. • www.superfluo.hr

Sveučilište u Zagrebu Agronomski fakultet
Svetošimunska cesta 25, 10000 Zagreb
Telefon: +385 (0)1 2393 777
E-mail: dekanat@agr.hr
Web: www.agr.unizg.hr

Oblici nastave

- Lectures
- Auditory Exercises
  observation and discussion of the production of biomass and biogass
- Laboratory practice/exercises
- Field work
- Seminars
  a panel discussion on the selected biofuel production

Ishodi učenja i način provjere

Ishod učenja	Način provjere
Explain models of production and use of RES in agriculture and their systematisation	Participating in the discussions, assignments during class - seminar, written and oral exam
Identify opportunities of using RES for energy production and to describe the possibility of utilization of agricultural biomass for energy generation	Participating in the discussions, assignments during class - seminar, written and oral exam
Identify opportunities for the production of biofuels from biomass and biogas from agricultural waste and residues	Participating in the discussions, assignments during class - seminar, written and oral exam
Enumerate the possibility of producing new-generation	Participating in the discussions, assignments during class - seminar, written and oral exam
Assess the possibility of applying the concept of biorefinery	Participating in the discussions, assignments during class - seminar, written and oral exam
Argue the importance of the use of biomass, biofuels and the RES on environment	Seminar

Način rada

Obveze nastavnika

Teacher uses material provided in content items, checks lessons learned and evaluates the students' knowledge and skills acquired through seminars, laboratory exercises, written and oral exam. All teaching materials are organized and available in Moodle system, as a forum for communication with students, with information related to the course, tasks for the establishment of knowledge a module, instructions for the use of teaching materials with separate units, lectures and evaluation of student assignments, written examinations, conducting oral examinations.

Obveze studenta

Attending lectures, laboratory exercises and seminars is required, students have to participate in learning in the course through the system for e-learning. During the first two weeks of classes, students should log into the system for e-learning Moodle, where they are provided with presentations and other learning materials, along with terms for the exam.

Polaganje ispita

Developed by Superfluo d.o.o. • www.superfluo.hr

Sveučilište u Zagrebu Agronomski fakultet
Svetošimunska cesta 25, 10000 Zagreb
Telefon: +385 (0)1 2393 777
E-mail: dekanat@agr.hr
Web: www.agr.unizg.hr

Elementi praćenja	Maksimalno bodova ili udio u ocjeni	Bodovna skala ocjena	Ocjena	Broj sati izravne nastave	Ukupni broj sati rada prosječnog studenta	ECTS bodovi
Written and oral exam	90 %	0-60 61-70 71-80 81-90 91-100	Nedovoljan (1) Dovoljan (2) Dobar (3) Vrlo dobar (4) Izvrstan (5)	26	78	2.5
Preparation and presentation of seminar work	10 %	0-60 61-70 71-80 81-90 91-100	Nedovoljan (1) Dovoljan (2) Dobar (3) Vrlo dobar (4) Izvrstan (5)	4	12	0.5
Total	100			30	90	3

Elementi praćenja	Opis	Rok	Nadoknada
Partial exam 2	It includes second part of the module: the production of first and second generation biofuels, biodiesel and ethanol, the production of second-generation biofuels, BTL and alcoholic second-generation biofuels, biofuels	10. week	
Partial exam 3	It includes third part of the module: third and fourth generation of biofuels, biogas production,	15. week	
Oral exam	Oral exam consisting of five questions; theory and fact, analytical skills, critical thinking, creativity and social responsibility.		

Developed by Superfluo d.o.o. • www.superfluo.hr

Sveučilište u Zagrebu Agronomski fakultet
Svetošimunska cesta 25, 10000 Zagreb
Telefon: +385 (0)1 2393 777
E-mail: dekanat@agr.hr
Web: www.agr.unizg.hr

Tjedni plan nastave

1. Definition of renewable energy sources (RES) and using of ES in agriculture L - Fossil energy resources classification: oil, coke, natural gas, nuclear energy; production and consumption of fossil fuels.RES classification: solar, wind, geothermal energy sources and hydroelectric energy. Energy and RES production – solar, wind, geothermal and hydropower, their interconnection in the systems of agricultural production of rural areas
2. Definition of renewable energy sources (RES) and using of ES in agriculture L - Fossil energy resources classification: oil, coke, natural gas, nuclear energy; production and consumption of fossil fuels.RES classification: solar, wind, geothermal energy sources and hydroelectric energy. Energy and RES production – solar, wind, geothermal and hydropower, their interconnection in the systems of agricultural production of rural areas
3. Biomass classification according to its origin L - Definiton of biomass, according to its origin. Biomass clasification in agriculture, its energy potential and energy crops.
4. Biomass preparation for efficient energy production L - Technologies of biomass conversion for efficient production of electrical and thermal energy from agricultural biomass.
5. Biomass quality analyses in energy production E - Physico-chemical analyses in production of electrical and thermal energy.
6. Production and utilization of 1st and 2nd generation of biodiesel fuel L - Production technology and utilization of first-generation biodiesel produced from oilseeds, and utilization of its production by-products in agricultural production. Production technology and utilization of BtL fuel produced from lignocellulosic biomass. Production processes, raw material and potential of its utilizationin agriculture and transport.
7. Production and utilization of 1st and 2nd generation alcohol-based biofuels L - Production technology of first-generation alcohol-based biofuels (bioethanol, biobutanol and biomethanol) produced from sugar and starchy materials, and their utilization in agriculture and transport. Production technology of second-generation alcohol-based biofuels (bioethanol, biobutanol and biomethanol) produced from lignocellulosic material, and their utilization in agriculture and transport.
8. Biogas production via utilization of organic waste in agriculture L - Classification of organic waste in agricultural and food production. Definiton of anaerobic digestion as a method of organic waste utilization. Different types of biogas utilization.
9. Biogas production via utilization of organic waste in agriculture L - Classification of organic waste in agricultural and food production. Definiton of anaerobic digestion as a method of organic waste utilization. Different types of biogas utilization.
10. Quality analyses of first and second generation biofuels E - Physico-chemical analyses of biodiesel and alcohol-based fuels and analyses of raw material for biogas production.
11. Biofuels of the new generation L - Definition of the future world biofuel production. Classification, production, and utilization of the third and forth generation biofuels produced from algae, fungi, yeast and other raw materials. Definition of refinery and biorefinery. Introduction to biorefinery concept in biomass and biofuels production in agriculture.
12. Field work F - Visiting biofuel plants in Croatia.
13. Field work F - Visiting biofuel plants in Croatia.
14. Seminar S - Seminar themes in agreement with each student
15. Seminar S - Seminar themes in agreement with each student

Developed by Superfluo d.o.o. • www.superfluo.hr

Sveučilište u Zagrebu Agronomski fakultet
Svetošimunska cesta 25, 10000 Zagreb
Telefon: +385 (0)1 2393 777
E-mail: dekanat@agr.hr
Web: www.agr.unizg.hr

Obvezna literatura

1. Soetaert, W. (2008): Biofuels, Book, Wiley, Germany
2. Dewulf, J.; Van Langenhove, H. (2007): Renewables Based Technology, Book, Wiley, SAD.
3. Shah, V. (2010): Emerging Environmental Technologies, Springer, USA
4. El Bassam, N. (2010): Handbook of Bioenergy Crops - A Complete Reference to Species, Development and Applications, Earthscan, London

Preporučena literatura

1. Mittelbach M.; Remschmidt, C. (2004): Biodiesel – the compprehensive handbook, Graz, Austria
2. Deublein, D.; Steinhauser, A. (2008): Biogas from Waste and Renewable Resources, Book, Wiley, Germany
3. Kamm, B.; Gruber, P.; Kamm, M. (2006): Biorafineries – Industrial processes and products, Wiley, Germany
4. Demirbas, A.; Demirbas, M.F. (2010): Algae as a New Source of Biodiesel, Springer, Turkey
5. O'Keefe, P.; O'Brien, G.; Pearsall, N. (2010): The Future of Energy Use; Earthscan, London

Sličan kolegij na srodnim sveučilištima

- University of Wageningen, Holland,; MS study, Biosystems engineering, course Biological Processes in Resource Recovery
- Humboldt State University, USA, MS study Environmental Resources Engineering, course Renewable Energy Power Systems
- Stanford University, USA, MS study Earth, Energy, and Environmental Sciences, course Research in Earth, Energy, and Environmental Science
- University of Ghent, Belgium, MS study Rural Development and Agricultural Economics, course Climate and Energy Management

Developed by Superfluo d.o.o. • www.superfluo.hr