

COURSE DESCRIPTION

- Course name: GREEN FUELS AND ENVIRONMENT

<i>Form of course</i>	<i>Lecture</i>	<i>Tutorial</i>	<i>Laboratory</i>	<i>Project</i>	<i>Seminar</i>
<i>Total number of hours</i>				46	14
<i>Form of completion</i>				Reports	Presentation

- Initial requirements: basics of chemistry

Name, surname, title of teacher:

- DSc, PhD. Marek Kułczyński
- Prof. Marek Bryjak
- PhD Krzysztof Kierzek

- Aims of course and educational outcomes:

aims:

- To make the students conversant with basics of fuel chemistry.
- To make the student acquire sound knowledge of properties of biofuels
- To acquaint the student with concepts of important processes of separation and supercapacitors.
- To acquaint the students with the basics of green fuels, their properties and applications.
- To acquaint the student with concepts of electric vehicles and mobile electric storage systems.

educational outcomes:

- The student has a deep knowledge of biofuels,
 - Lists and explains the processes of fuel technology and current trends in their development
 - He knows, understands and can use the knowledge of biofuels in practice
- Form of teaching (traditional / e-learning): traditional
 - Short description of the course content:

The presented course aims to provide participants with information on fuel properties, with particular emphasis on biofuels, and the impact of their use on environmental protection. The course will provide knowledge related to fuel economy - types of fuels, standards, the ability to manufacture and store fuels, etc.

The characteristics of liquid and gaseous fuels in relation to the composition of fumes in terms of their impact on the natural environment will be presented. Will be discussed technologies for the production of fuels, especially alternative fuels and biofuels.

Use of new separation methods for the purification of waste streams and the recovery of valuable compounds will be discussed. Issues related to the use of supercapacitors and lithium ion batteries that affect the development of motoring will be discussed.

The projects implemented by the participants of the course will be related to both the characteristics of biofuels and technologies for their acquisition, taking into account the latest trends in this field, as well as the use of membranes and supercapacitors.

Students will work in teams of several people and the results of their work will be presented during the course and evaluated by the teacher at the final meeting.

- Seminar – content:

Form of classes - lecture		Number of hours
Sem 1	Biofuels - fuel properties, with particular emphasis on biofuels, and the impact of their use on environmental protection. Fuel economy - types of fuels, standards, the ability to manufacture and store fuels, etc. The characteristics of liquid and gaseous fuels in relation to the composition of fumes in terms of their impact on the natural environment. Technologies for the production of fuels, especially alternative fuels and biofuels.	4
Sem 2	Supercapacitor – principle, construction and applications” Lithium-ion batteries – from research to real technology	4
Sem 3	The use of innovative sorption processes (mixed matrix, solvent impregnated resins, core-shell materials, interpenetrated networks) The use of membrane processes (filtration, electro-dialysis, pervaporation and membrane distillation) The use of hybrid processes (sorption-membrane filtration, membrane integration)	4
Sem 4	Summary and discussion	2
Total hours		14

- Project - content:

Form of classes - project		Number of hours
Proj1	European automotive policy due to environmental aspects, Properties of engines’ fuels, Designed fuel	4
Proj2	Gas fuels – LPG, CNG, LNG	4
Proj3	Bio-fuels and bio-components	4
Proj4	Hydrogen as engine fuel	4
Proj5	Characteristics of motor gasolines	4
Proj6	“Evaluation of negative and positive electrode performance in Li-ion cell”	4
Proj7	Removal of heavy metals from aqueous solutions	4
Proj8	“Evaluation of supercapcitor electrode materials in organic and aqueous electrolyte”and	4
Proj9	Recovery of organic species from aqueous solutions/emulsions	4
Proj10	Obtaining biodiesel using microwave energy	5
Proj11	Characteristics of the biodiesel	5
Total hours		46

- Basic literature:

- Kułażyński Marek: Green fuels, Automotive Engineering, Wrocław University of Technology; 2011, pp.103.
- Kułażyński Marek, Sroka Zbigniew J: Green fuels laboratory, Automotive Engineering, Wrocław University of Technology, 2011. pp. 76.

- Kirk R. Smith: Biofuels, Air Pollution, and Health: A Global Review Springer Science & Business Media, 11 mar 2013 – pp 476
- James G Speight: The Biofuels Handbook, Royal Society of Chemistry, 5 July 2011 – pp 574
- Supercapacitors: Materials, Systems, and Applications, ed. F. Beguin and E. Frackowiak, Wiley 2013
- Carbons for Electrochemical Energy Storage and Conversion Systems, ed. F. Beguin and E. Frackowiak, CRC Press 2009
- Marek Bryjak, Nalan Kabay, Bernabe L. Rivas, Jochen Bundschuh, Innovative Materials and Methods for Water Treatment: Solutions for Arsenic and Chromium Removal (2016),
- Nalan Kabay, Jochen Bundschuh, Bruce Hendry, Marek Bryjak, Kazuharu Yoshizuka, Prosun Bhattacharya, Suer Anac, The Global Arsenic Problem: Challenges for Safe Water Production, (2007)

- Additional literature:

- Beata Narowska, Marek Kułczyński, Marcin Łukaszewicz. Sunflower oil as a substrate for biofuel production. w: Sunflower Oil: Interactions, Applications and Research. (red.) MD Monwar Hossain. NOVA Science Publishers, New York, 2017, s. 83-119
- Nalan Kabay, Marek Bryjak, M., Nidal Hilal, Boron Separation Processes (2015),

- Completion rules: participation in seminars and projects, final test