UNIVERSITY OF WARMIA AND MAZURY
Faculty of Agriculture and Forestry

56S1-TECHNBIO **BIOENERGY TECHNOLOGIES** **ECTS: 3.0**

HOURS PER SEMESTER/WEEK: LECTURES: 15/1; CLASSES: 30/2
FIELD OF THE STUDY: Environmental protection
Level of study: First-cycle (Engineer's degree) program

Course status: obligatory *
Year of the study: III

COURSE CONTENTS
LECTURES: Agroenergy, idea and prospects. The idea of an agro-energy complex in the commune: biomass heating plant, agricultural biogas plant, biodiesel agricultural refinery. Characteristics of conventional and unconventional fuels. The structure of the use of renewable energy sources in Poland, the EU and in the world. Poland's commitments towards the EU in the field of implementation of bioenergy technologies. Qualification and standardization of biomass as an energy resource. Aspects supporting the use of renewable energy sources. Legal acts and standards for biofuels. Division of biomass fuels, taking into account the method of their production: solid, liquid and gaseous fuels. Systems for generating heat and electricity from biomass. Impact of using biomass fuels on the natural environment. Briquettes and pellets from the remains of plant production and agri-food industry.

CLASSES: LABORATORY: Thermophysical properties and chemical composition of biomass. The heat of combustion and calorific value of biofuels. Ash content and elemental composition of biomass fuels. TUTORIALS: Basic definitions, quantities and units of measurement concerning energy. Sources of biomass origin. Agrofuels from the products and residues of agriculture. Biomass of agricultural plants as an energy resource. Elevating nutrients with biomass of energy plants and determining the fertilizing value of ash. FIELD EXERCISES: Technologies of cultivation and obtaining biomass for energy purposes. Biomass conversion technologies to secondary energy carriers.

EDUCATIONAL PURPOSE: Acquisition of knowledge, skills, and competencies in the field of quality of biomass and biofuels and the technology of their processing and the possibility of using them to generate bioenergy.

LEARNING OUTCOMES
Knowledge. Knows and characterizes renewable and non-renewable energy sources. He knows the technologies of biomass processing into bioenergy.
Skills. Has the ability to determine the thermophysical and chemical properties of biomass and identify plant species and genera biofuels.
Social competences. Understands the need to constantly follow the progress in the development of bioenergy technologies and their transformation into practical use.

TEACHING FORMS AND METHODS
Lectures. Informative lecture with a multimedia presentation.
Classes. Field classes and laboratory exercises combined with performing analyzes and calculations.

FORM AND CONDITIONS FOR VERIFICATION OF LEARNING OUTCOMES
Lectures. Written test - pass on the basis of a test, combined with two written tests from exercises, pass for at least 50% of correct answers.
Classes. Lab exercises: Written test - pass on the basis of a test, combined with two written tests from exercises, pass for at least 50% of correct answers. Field exercises: Practical test - recognition of perennial energy plants on the basis of morphological fea

BASIC LITERATURE
1) Szczukowski S., Tworkowski J., Stolarski M., Kwiatkowski J., Krzyżaniak M., Lajszner W., Graban Ł, Wieloletnie rośliny energetyczne, technologie energii odnawialnej, Wyd. Multico, 2012. 2) Stolarski M.J, Ocena właściwości termofizycznych i chemicznych paliw stałych. Rozdział VII w monografii pt. Analityka i monitoring środowiska. Teoria i praktyka, Wyd. UWM Olsztyn, 2011.

ADDITIONAL LITERATURE
1) Kołodziej B., Matyka M., Odnawialne źródła energii. Rolnicze surowce energetyczne, Wyd. PWRiL, 2012. 2) Stolarski M.J., Gołaszewski J., Redakcja monografii pt. Biorafineria lignocelulozowa– uwarunkowania środowiskowe, energetyczne i społeczno-ekonomiczne, Wyd. UWM Olsztyn, 2015.

THE TEACHER/TEACHERS CONDUCTING THE CLASSES:
prof. dr hab. Mariusz J. STOLARSKI mariusz.stolarski@uwm.edu.pl
Department of Genetics, Plant Breeding and Bioresource Engineering
Plac Łódzki 3, 10-721 Olsztyn, POLAND

* note: optional course availability depends on Polish students' choice!