UNIVERSITY OF WARMIA AND MAZURY IN OLSZTYN

Faculty of Food Sciences

Course title: FOOD PHYSICS AND RHEOLOGY

ECTS credit allocation (and other scores): 4

Semester: spring

Level of study: : ISCED-7 - second-cycle program EQF-7

Branch of science: Agricultural sciences

Language: English

Number of hours per semester: 25h lectures / 20h classes

Course coordinator/ Department and e-mail: dr hab. inż. Fabian Dajnowiec/ Department of Process Engineering Equipment and Food Biotechnology/ fabian.dajnowiec@uwm.edu.pl

Type of classes: classes and lectures

SUBSTANTIVE CONTENT

CLASSES: Laboratory exercises - familiarisation with working on a viscometer comparative, capillary rheometer and several types of rotational rheometers, sieve analysis, osmotic dewatering.

LECTURES: Basic concepts of rheology - stress, strain, rate of strain, shear, elastic and viscous response, time scale of of deformation. Newtonian and non-Newtonian fluids, classification of fluids non-Newtonian fluids, flow curve as a basic characteristic of non-Newtonian fluids. Mathematical description - equations describing flow curves of the different types of fluids. Structure of non-Newtonian fluids and mechanisms determining their rheological properties. Determination of flow curve and normal stresses, oscillation studies. Comparative viscometers, capillary and rotational. Physical properties of food products and intermediates - thermal conductivity, thermal diffusivity, specific heat, calorific value, membrane permeability calorific value, permeability of membranes used as packaging, moisture content, water activity, particle shape and size, specific surface area. Moisture sorption phenomena, surface phenomena, emulsions, microwave heating, irradiation.

Learning purpose: To familiarise the student with basic concepts connected with rheology of non-Newtonian fluids with particular emphasis on substances encountered in the food industry, with structural mechanisms causing various types of non-Newtonian properties, with construction and operation of various types of measuring instruments used to test properties of such fluids, and with using the results of such tests to design and control technological processes. Familiarise the student with the methods of determining and the role and significance of physical properties such as thermal conductivity, thermal diffusivity, specific heat, permeability of films used for packaging, moisture, water activity and the characteristics of size and shape of particles forming the granular layer in food processing, and with the physical basis of moisture sorption, surface phenomena, microwave heating and irradiation with ionising radiation..

ON COMPLETION OF THE STUDY PROGRAMME THE GRADUATE WILL GAIN:

Knowledge: student knows and understands the basic concepts of rheology, the relationship between fluid structure and rheological properties, the basic mechanics of non-Newtonian fluids and the basic laboratory techniques used to study the rheological properties of such fluids. Knows and understands the importance and role in food processing of physical properties such as thermal conductivity thermal conductivity, thermal diffusivity, specific heat, permeability of membranes used for packaging, moisture content, water activity, particle shape and particle size, and methods of measuring them.

Skills: student is able to carry out tests on the rheological properties of fluids non-Newtonian fluids, interpret their results correctly and use them to design and control processes.

Social Competencies: student is aware of the need to work as part of a team, responsibly carries out tasks in accordance with his/her position in the group.

Basic literature:

1. Mezger T., , Rheology Handbook, Wyd. Vinzenz Verlag, R. 2002
2. Norton I.T., Spyropoulos F., Cox P., , Practical Food Rheology: An Interpretive Approach, Wyd. Wiley , R. 2011
3. Barnes H., , A Handbook of Elementary Rheology, Wyd. Uniweristy of Wales, R. 2000
4. Arana I., , Physical Properties of Foods: Novel Measurement Techniques and Applications, Wyd. CRC Pres, R. 2012
5. Figura L., Teixeira A.A., Food physics: physical properties -measurement and application, Wyd. Springer, R. 2007

The allocated number of ECTS points consists of: 49 contact hours with an academic teacher: Student's independent work: 51