Course title: Heat and Mass Transfer Processes	**Neptun code: GEAHT406-a**
Course coordinator: name, position, scientific degree: **Dr. Norbert Szaszák, associate professor, Ph.D.**	
type and number of lesson: lecture/seminar/practical lesson/consultation: **20**/ week or **semester**	
method of accountability: **colloquium**/practical mark/other	
curriculum location of the subject: **autumn**/spring	
pre-study conditions: GEAHT402-a	

The task and purpose of the subject:

This course provides an introduction to topics such as fluid mechanics and heat & mass transfer processes. The relevance of the topic will be demonstrated by examples from industry and the theory will by supported by problem- based case studies providing the possibility for students to apply the knowledge to unfamiliar problems related to fluids at rest and in motion as well as to heat and mass transfer processes. Characterising fluid problems and mass transfer processes are major aspects of chemical engineers. The introduction to engineering concepts and design strategies will help students to identify types of flows and to select appropriate models to develop new heat and mass transfer processes or improve existing ones. By working on practical exercises and projects; students will reinforce theoretical concepts of mass transfer operations in chemical engineering, with a specific focus on solid-liquid and solid-solid systems. The development of skills that help students to breakdown problems and identify relevant heat and mass transfer concepts is another important aspect of this course.

Course description:

Fluids
• Fluid properties such as density and viscosity, pressure (Pascal’s law) and stresses in fluids
• Basic fluid dynamic principles e.g. continuity equation, Bernoulli’s equation and flow pattern/ flow types (laminar and turbulent flow)
• Energy equation, Poisseuille’s equation, D’Arcy’s equation
• Velocity measurement, flowrate measurement (orifice and venturi meter)
• Handling of solids (principal conveyor types; gravity chute, belt, chain, vibratory chute, air slide and pneumatic conveyor, with a detailed focus on the operation and key components of the latter)

Mass transfer
• Diffusion on molecular level (Fick’s law) and on bulk level (convective flows),
• Drying of solids (drying methods, equipment, characterisation of humidity, heat, enthalpy, psychrometric charts, adiabatic saturation and wet-bulb temperatures)
• J-factor analogy (mass and momentum transfer analogies)
• Mass transfer coefficients

Heat Transfer
• Conduction and convection (Fourier’s equation)
• Thermal circuits: combinations of heat transfer modes in series and parallel, including radiation.
• Boiling and condensing heat transfer.
• Introduction to heat exchanger design (Effectiveness-NTU and F-factor method) Heat conduction and flow in isotropic solids. Cross effects. Rheology. Poynting-Thomson body.

Required literature:

1. White, F.M.: Fluid Mechanics. 4th Edition, McGraw-Hill, Boston, 1999.

2. Roberson, J.A. - Crowe, C.T.: Engineering Fluid Mechanics. 3rd Edition, Houghton Mifflin Company, Boston, 1985
3. Matolcsi, T., Ordinary thermodynamics, 2005, Academic Publishers, Budapest.
4. Bejan, A., Advanced Engineering Thermodynamics, 2006, Wiley.
5. Verhás, J., Thermodynamics and rheology, 1997, Kluwert-Academic, Budapest.
6. Prigogine, I. and Kondepudi, D., Modern Thermodynamics: From Heat Engines to Dissipative Structures, 1998, Wiley.
7. Kjelstrup, S., Bedeaux, D., Johannessen, E. and Gross, J., Non-Equilibrium Thermodynamics for Engineers, World Scientific, New Jersey-etc., 2010.

Recommended literature:

1. Dr. Czibere Tibor: Vezetéses hőátvitel. Miskolci Egyetemi Kiadó, 1998
2. Dr. Czibere Tibor: FOLYÉKONY KONTINUUMOK TURBULENS MOZGÁSA, előadás jegyzet