# Course Catalogue
# Szent István University
# School of Mechanical Engineering

**Gödöllő**
**2008-2009**

## SCHOOL OF MECHANICAL ENGINEERING

THEORY AND PRINCIPLE OF DRYING
BEKE, János Professor

SIMULATION OF LOGISTICAL PROCESSES
BENKŐ, János Professor

PROJECT MANAGEMENT
DARÓCZI, Miklós Associate Professor

COMPUTER SIMULATION
PROCESS CONTROL
FARKAS, István Professor

MACHINES OF ANIMAL HUSBANDRY AND FEED MIXTURES
FOGARASI, Lajos Associate Professor

AIR PURITY PROTECTION
GÉCZI, Gábor Assistant Professor

ECONOMICS AND MANAGEMENT OF FARM MACHINERY
ENTERPRISE MANAGEMENT
HUSTI, István Professor

INTERNAL COMBUSTION ENGINES/EXPERIMENTAL METHODS AND ADVANCED APPLICATIONS
HYDRAULIC ENERGY TRANSMISSION
JÁNOSI, László Associate Professor

FRICTION AND WEAR OF STRUCTURAL MATERIALS (TRIBOLOGY)
KALÁCSKA, Gábor Associate Professor

INFORMATION AND MONITORING SYSTEM OF VEHICLES
KISS, Péter Associate Professor

ORDINARY DIFFERENTIAL EQUATIONS
STABILITY THEORY
KÓSA, András Professor

BASIC THEORY OF AGRICULTURAL TRACTORS AND OFF-ROAD VEHICLES
LAIB, Lajos Professor

MATERIAL SCIENCE
MECHANICAL ENGINEERING TECHNOLOGY I.
MECHANICAL ENGINEERING TECHNOLOGY II.
PELLÉNYI, Lajos Associate Professor

ELECTRICAL MEASUREMENT OF MECHANICAL QUANTITIES
PETRÓCZKI, Károly Associate Professor

BUILDINGS OF AGRICULTURAL TECHNOLOGIES
ARCHITECTURE OF VILLAGES AND FARMS
RUDA, Győző Assistant Professor

PARTIAL DIFFERENTIAL EQUATIONS
SEBESTYÉN, Zoltán Associate Professor

ELECTROTECHNICS
SEMBERY, Péter Professor

SENSOR PHYSICS
SERES, István Associate Professor

PHYSICS I.
PHYSICS II.
SERES, István Associate Professor and
MÉSZÁROS, Csaba Associate Professor

MACHINE ELEMENTS DESIGN
SZABÓ, István Associate Professor

SOLAR ENGINEERING
SZABÓ, Márta Associate Professor

FLUID MECHANICS
SZLIVKA, Ferenc Associate Professor

GREEN ARCHITECTURE
SZŰCS, Miklós Scientific Research Fellow

BASES OF ENERGETICS
TÓTH, László Professor

MATHEMATICAL SYSTEMS THEORY
MATHEMATICS IV.
VARGA, Zoltán Professor

FOOD ENGINEERING
VÁRSZEGI, Tibor Assistant Professor

## SCHOOL OF MECHANICAL ENGINEERING

**School of Mechanical Engineering**
**Institute of Process Engineering**

*Course title*
**THEORY AND PRINCIPLE OF DRYING**
ECTS Credit: 3
*Instructor*
**BEKE, János Professor**

**Overview**

The course is based on a basic knowledge of Thermodynamics and some parts of Hydraulics. After an overview of the most important physical, caloric and hydraulic properties of drying (first of all agricultural) material, students will learn about the drying process, as a simultaneous heat and mass transport and typical drying processes used in the agriculture. The advantages and disadvantages of different drying processes (convective, contact, infrared, vacuum, microwave methods) and constructions will be discussed. Particular attention will be paid to the energetics of the drying process, quality problems in drying materials and the criteria of sustainable development.

**Topics of the course:**

1. Agrophysical properties of drying materials.
   Water and material systems in drying materials. Water regime.
   Properties of humid air. Humid air as an ideal and a real gas.
2. Typical heat and mass transfer in drying. Global and particular descriptionof water movement inside the drying material.
3. Practical methods to analyse the dewatering process. Analogue theory, and dimension analysis.
3. Global overview of typical drying processes. Theory of convective, conductive, infrared, microwave drying methods.
4. Analysing the convective drying process. Thin and thick layer drying.
6. Analysing the non-convective drying processes. Possibility of changingenergy transfer method in drying.
7. Characteristic processes and machines of grain drying.

7-14. Drying of oil and seed grains. Typical methods and machines of green forage drying. Tobacco curing. Energetics of drying. Modelling problems of drying.

**School of Mechanical Engineering**
**Institute of Environmental Industry, Department of Logistics**

*Course title*
**SIMULATION OF LOGISTICAL PROCESSES**
*Course Unit code*
**GEK-SoLP-0809**
ECTS Credit: 4
*Instructor*
**BENKŐ, János Professor**

### Overview

Spreading of the high speed computers gave impulse to development and application of simulation technologies. Due to these the discrete simulation became important device of the logistical planning. Recent past a lot of software appeared in the market. The graphic programming systems means the high-tech among software, that able to determine parameters and characteristics of complex systems without writing any program row. In the subject the ARENA software with logistical applications will be reviewed.

### Topics of the course

1. What is simulation
2. Modelling, Computer simulation, When simulation are used.
3. Pieces of a simulation
4. Entities, Attributes, Variables, Resources, Queues, Statistical accumulators, Simulation clock.
5. Randomness simulation
6. Random input, random output, Replicating the example.
7. Exploring the Arena window
8. Opening a model, Basic interaction and pieces of Arena window, Moving around and up and down in the flowchart view, Modules.
9. Browsing through an existing model
10. The create flowchart module, The entity data module, The process flowchart module, The resource data module, The queue data module, Animating resources and queues, The dispose flowchart module, Connecting flowcharts module, Dynamic plots, Setting the run conditions, Running, Viewing the reports
11. Building model Yourself
12. New model window and basic process panel, Place and connect the flowchart module, The create flowchart module, Displays, The entity data module, The process flowchart module, The resource and queue data module, Resources animation, The dispose flowchart module, Dynamic plots, Window dressing, The Run>Setup dialog boxes, More on menus, toolbars, drawing and printing.
13. An electronic assembly and test system
14. Developing a model approach, Building the model, Running the model, Viewing the result.
15. The enhanced electronic assembly and test system
16. Expanding resource representation: schedules and states, Resource schedules, Resource failures, Frequencies, Results of the model.
17. Enhanced the animation
18. Changing animation queues, Changing entity pictures, Adding resource pictures, Adding variables and plots.
19. The electronic assembly and test system with part transfer
20. Some new Arena concepts: station and transfer, Adding the route logic, Altering the animation
21. Input analysis: specifying model parameters and distributions
22. Deterministic vs. random inputs, Collecting data, Using data, Fitting input distributions via the input analyzer.

Text: **Arena Standard User's Guide Rockwell Software 2002.**

**School of Mechanical Engineering**
**Institute of Systems Engineering and Management**

*Course title*
**PROJECT MANAGEMENT**
ECTS Credit: 3
*Instructor*
**DARÓCZI, Miklós Associate Professor**

**Overview**

The main **objective** of the course is to deliver the theoretical and methodological knowledge related to the project planning and accomplishing. The main **chapters** of the course: fundamentals of project management, the process and participants of project accomplishment, developing the contract strategy, planning of projects, controlling work in progress, economic evaluation of projects. Based on these studies the students will be **able** to participate in project planning and implementation. The course presupposes a basic knowledge of Management. (Further information: daroczi.miklos@gek.szie.hu)

**Topics of the course**

1. Course introduction, schedule and home work, course material and requirements
2. Fundamentals and development of Project Management
3. The process and participants of project accomplishment I.
4. The process and participants of project accomplishment II.
5. Developing the contract strategy I.
6. Developing the contract strategy II.
7. Planning the three project parameters
8. Planning the time dimension (Gantt-charts, CPM diagram) I.
9. Planning the time dimension (Gantt-charts, CPM diagram) II.
10. Planning the resource dimension
11. Planning the cost dimension
12. Computer aided project planning and implementation
13. Controlling work in progress
14. Economic evaluation of projects
15. Home work presentations, final lecture

**School of Mechanical Engineering**
**Institute of Environmental Systems**

*Course title*
**COMPUTER SIMULATION**
ECTS Credit: 3
*Instructor*
**FARKAS, István Professor**

**Overview**

The course presupposes a basic knowledge of Mathematics and Physics. The subject consists of a mixture of lectures and computer exercises, using Matlab and Simulink software. Different case studies will be presented and discussed based on engineering practice. (Further information: ifarkas@fft.gau.hu)

**Topics of the course**

16. Introduction to the basic concepts.
2. Introduction to using Matlab, basic commands and functions (Computer exercise).
3. Introduction to a block oriented simulation tool using Simulink. Construction of simple models (Computer exercise).
4. Modelling and simulation of dynamic systems, differential equations and their solutions.
5. Presentation of a case study: Thermal behaviour of an electrical engine.
6. Simulation of the thermal behaviour of an electrical engine (Computer exercise).
7. Modelling and simulation of different meteorological parameters.
8. Realization of the meteorological models (Computer exercise).
9. Modelling and simulation of a solar hot water system.
10. Realization of a solar hot water system model (Computer exercise).
11. Modelling and simulation of greenhouse processes.
12. Realization of the greenhouse process model (Computer exercise).
13. Individual project work, including small written report.
14. Individual project work, including small written report.
15. Short presentation and discussion of the individual project work.

**School of Mechanical Engineering**
**Institute of Environmental Systems**

*Course title*
**PROCESS CONTROL**
ECTS Credit: 6
*Instructor*
**FARKAS, István Professor**

**Overview**

The course presupposes a basic knowledge of Mathematics and Physics. After getting familiar with the fundamentals of process control, students will learn about the development of mathematical modelling considerations for control purposes. The main part of the study covers the analysis of the dynamic behaviour of different processes. An introduction and analysis of feedback controlled processes is also included.
Further information: ifarkas@fft.gau.hu

**Topics of the course**

1. Incentives for process control.
2. Design aspects of a process control system.
3. Hardware for a process control system.
4. Development of a mathematical model.
5. Modelling considerations for control purposes.
6. Computer simulation and the linearization of nonlinear systems.
7. Laplace transforms.
8. Solution of linear differential equations using Laplace transforms.
9. Transfer functions and input-output models.
10. Dynamic behaviour of first-order systems.
11. Dynamic behaviour of second-order systems.
12. Dynamic behaviour of higher-order systems.
13. Introduction to feedback control.
14. Dynamic behaviour of feedback-controlled processes.
15. Written exam.

**School of Mechanical Engineering**
**Department of Agroenergetics and Food Engineering**

*Course title*
**MACHINES OF ANIMAL HUSBANDRY AND FEED MIXTURES**
ECTS Credit: 3
*Instructor*
**Lajos FOGARASI, Associate Professor**

**Overview**

The course presupposes knowledge of Animal Husbandry and Machine Elements and General Science of Mechanics. Special machines, equipment and constructions will be shown and discussed in the field of engineering, animal husbandry (farming) and, because of its importance, animal feed processing.

**Topics of the course**

1. Animal husbandry: general characterization.
2. Mechanization of animal feeding: chopping, choppers and its construction / feed conservation by fermentation / horizontal and vertical silos / technology of making silage and fermented hay /grinding of feed components / making feed mixtures in place and mixing transporters / built-in feed distribution systems.
3. Milking: about milking cows / milking equipment and its working / milking parlors and systems / automatization of milking equipment / milking robots.
4. Milk handling: composition and other material properties of milk / hygiene and sanitation of equipment. Milk cooling: refrigeration /cooling compressors/ cooling devices (heat exchangers) / storing tanks of cooled milk.
5. Sterilization (pasteurization) of raw milk.
6. Animal farming technologies: environment and installation in animal houses / feeding /drinking / bedding / manure removing / manure handling and use.
7. Computer-aid management / operation in animal farms.
8. Milking robots. Feed mixtures / general conditions.
9. Storage and preparation of raw materials.
10.-13. Feed mixers: theory of mixing solid feed components / homogeneity of mixtures /charge mixers (drum / screw / horizontal rotating / reel / ribbon screw, pneumatic solutions), continuous mixers (drum / whirl varieties / conditioning screw mixer). Portioning devices: volumetric, weighing types.

**School of Mechanical Engineering**
**Department of Enviromantal Engineering**

*Course title*
**AIR PURITY PROTECTION**
ECTS Credit:
*Instructor*
**Gábor GÉCZI, Assistant Professor**

**Overview**

**Topics of the course**

1. Pollutants: Sources, Effects and Dispersion Modeling
2. Air Quality and Emission Measurements
3. Particulate Controls: Dry Collectors, Filters
4. Particulate Controls: Electrostatic Precipitators
5. Particulate Controls: Wet Collectors
6. Gaseous Emission Controls: Physical and Chemical Separation
7. Gaseous Emission Controls: Thermal Destruction
8. Gaseous Emission Controls: Biofiltration
9. Odor Control: Perception, Effect, Characterization and Strategy
10. Indoor Air Pollution: Radon and Other Pollutants
11. Visit of Industrial Buildings
12. Summary

**School of Mechanical Engineering**
**Department of Engineering Economics**

*Course title*
## ECONOMICS AND MANAGEMENT OF FARM MACHINERY
ECTS Credit: 4
*Instructor*
**István HUSTI, Professor**

### Overview

The course presupposes a basic knowledge of applied microeconomics and economic management. After an overview of theoretical rudiments, students will read and learn the optimal developing processes of farms and agricultural enterprises. Farm machinery will be at the centre of the studies.

### Topics of the course

1. Objectives of technical development.
2. Significance of innovation processes.
3. Substance of agricultural innovation.
4. Components and influencing elements of technical development.
5. Economic influence-mechanism of technical development.
6. Development of mechanisation as the core of complex technical development.
7. Economic relations of agricultural mechanisation.
8. Management relations of economical use of machinery.
9. Economic optimum of machinery usage.
10. Determination of optimum operational period .
11. Economic relations of sort-out and secondary utilisation .
12. Perspective of technical development in Hungarian agriculture .
13. State subsidy of technical development in agriculture.
14. Summary .

**School of Mechanical Engineering**
**Department of Engineering Economics**

*Course title*
**ENTERPRISE MANAGEMENT**
ECTS Credit: 4
*Instructor*
**István HUSTI, Professor**

**Overview**

The course presupposes a basic knowledge of applied microeconomics and enterprise management. After an overview of theoretical rudiments, students will learn how to manage business enterprises from A-Z.

**Topics of the course**

1. The objectives of Enterprise Management.
2. Theoretical rudiments and basic relations of enterprises.
3. Legal forms of business enterprises. The franchise.
4. Basic economic processes of enterprises.
5. Functions of enterprise management. Significance of planning.
6. Strategy of enterprises.
7. Significance of marketing plans.
8. Business planning.
9. Management of production means.
10. Human-resource management.
11. Production management.
12. Financial management.
13. Controlling. Crisis management.
14. Development of company organisation. Business ethic.

**School of Mechanical Engineering**
**Department of Vehicles and Thermal Technology**

*Course title*
## INTERNAL COMBUSTION ENGINES/EXPERIMENTAL METHODS AND ADVANCED APPLICATIONS

ECTS Credit: 3
*Instructor*
**László JÁNOSI, Associate Professor**

### Overview

Assuming that the basics of internal combustion engines are known, the subject deals with some special experimental methods and the usage of renewable resources. Special consideration is given to learning to determine the efficiency of internal combustion engines by measuring and by computation.

Further information: ljanosi@jht.gau.hu

### Topics of the course

1. Usage of Comprehensive Resource by Automotive Professionals.
2. The Measurement of Temperature in IC Engines.
3. Pressure Measurement.
4. Force, Torque and Strain Measurements.
5. Measurements of Engine Performance/SAE, DIN, CUNA, ISO and other Standards.
6. Indirect Measurement of Engine Power by One and Two Independent Variable Method.
7. Determination of Engine Condition/Engine Diagnostics.
8. Ageing of Engines/Modelling and Simulation of Engines.
9. Ceramics in Engines.
10. Efficiencies of engines/Engine Indication.
11. Engine Indication in Lab.
12. Electromagnetic radiation sensors/Practice.
13. Environmental Impacts of IC Engines/Alternative Fuels.
14. Vegetable Oils as Engine Fuels.
15. Summary.

**School of Mechanical Engineering**
**Department of Vehicles and Thermal Technology**

*Course title*
**HYDRAULIC ENERGY TRANSMISSION**
ECTS Credit: 3
*Instructor*
**László JÁNOSI, Associate Professor**

**Overview**

The overriding thrust of this subject is to provide a practical methodology for designing fluid power circuits and systems – methods based on a careful analysis and definition of the job to be done. This definition approach is based on a detailed load analysis which is presented in graphic form. Further information: ljanosi@jht.gau.hu

**Topics of the course:**

1. Energy Transfer Systems.
2. Fluid Flow Fundamentals.
3. Hydraulic Fluids.
4. Hydraulic Motors/Pumps.
5. Hydraulic Cylinders.
6. Orifice Flow (laminar & turbulent) and Reservoirs.
7. Flow Control Valves.
8. Directional Control Valves.
9. Pressure Control Valves.
10. Electro Hydraulic Servos.
11. Hydrostatic Transmissions I.
12. Hydrostatic Transmissions II.
13. Filters/SAE Standards on Contamination.
14. Summary.
15. Final Exam.

**School of Mechanical Engineering**
**Department of Mechanical Engineering Technology and Maintenance of Machinery**

*Course title*
**FRICTION AND WEAR OF STRUCTURAL MATERIALS (TRIBOLOGY)**
ECTS Credit: 3
*Instructor*
**Gábor KALÁCSKA, Professor**

**Overview**

This course provides detailed knowledge about the most frequent failure processes: friction and wear. First, the properties and features of tribological systems are shown, then friction theories are discussed. After these, the different wear processes are studied, taking the engineering materials (metals, polymers, wood) into consideration. This is followed by the basics of lubrication as a third part of tribology, measurements and tribotesting.
Further information: kalacska.ggyt.mgk@mgk.gau.hu

**Topics of the course**

1. Historical review of tribology, introduction and background, basic definitions.
2. Tribological systems: classification of systems, elements, structures, features.
3. Role of tribological processes in mechanical systems. Contact processes.
4. Materials and properties used in tribo-systems.
5. Friction theories.
6. General description of wear mechanism, surface fatigue wear, adhesive wear processes.
7. Abrasive wear mechanism, fretting wear contact.
8. Written exam.
9. Stribeck curve and lubrication modes. Basics of different lubrication stages.
10. Influence of tribological processes on the structure of mechanical systems.
11. Tribometry: test, simulation and control methods.
12. Visit of tribology laboratory, BME.
13. Visit of tribology laboratory, GATE.
14. Consultation.
15. Written exam.

**School of Mechanical Engineering**
**Department of Automotive and Thermal Technology**

*Course title*
## INFORMATION AND MONITORING SYSTEM FOR VEHICLES
ECTS Credit: 3
*Instructor*
**Péter KISS, Associate Professor**

### Overview

The course presupposes knowledge of the monitoring systems for vehicles. Students will learn about the management of Diesel and Otto engines, the navigation systems of cars and trucks as well as comfort and convenience systems. They will also study the control system of tractors, cars and trucks and some details about car marketing.

### Topics of the course

1. Subjects of information and monitoring system of vehicles, classification.
2. Otto-engine management.
3. Diesel-engine management.
4. Navigation system of cars and truck.
5. Application of Global Positioning System in navigation.
6. Driver information system.
7. Comfort and convenience system.
8. Safety systems.
9. Parking system.
10. Control systems for exhaust emission.
11. Control system of tractors.
12. Vehicle marketing.
13. Marketing offer, local marketing offer.
14. Overview and discussion.
15. Oral exam.

**School of Mechanical Engineering**
**Department of Mathematics**

*Course title*
**ORDINARY DIFFERENTIAL EQUATIONS**
*Course Unit Code:*
**GEK-ODE-0809**
ECTS Credit: 3
*Instructor*
**András KÓSA, Professor**

**Overview**

The course is based on the introductory courses Mathematics I-IV, and is applied in majority of technical subjects. It is necessary for the courses Numerical Methods, Stability Theory, Partial Differential Equations and Mathematical Systems Theory.
Further information: akosa@mszi.gau.hu

**Topics of the course**

1. Basic concepts.
2. The Peano-Gronwall inequality.
3. Existence and uniqueness theorems I.
4. Existence and uniqueness theorems II.
5. Behaviour of solutions.
6. Linear systems.
7. Technics from matrics calculus.
8. Linear systems with constant coefficients. Written exam.
9. Characteristic function of a system of differential equations and its differentiability.
10. Variational equation of a system of differential equations. First order partial differential equations.
11. Higher order differential equations.
12. Boundary value problems.
13. Differential equations of Calculus of Variations.
14. The linear minimum time problem.
15. Written exam.

**School of Mechanical Engineering**
**Department of Mathematics**

*Course title*
## STABILITY THEORY
ECTS Credit: 2
*Instructor*
**András KÓSA, Professor**

### Overview

The course presupposes the course on Ordinary Differential Equations. It is offered in the second semester of the fourth year and, being a concluding subject, it includes several applications in engineering and physics. Further information: akosa@mszi.gau.hu

### Topics of the course

1. Practical problems raising in the investigation of stability.
2. Basic concepts of Stability Theory.
3. Autonomous systems. Trajectories.
4. Ljapunov functions. Derivative with respect to a system of differential equations.
5. Ljapunov's direct method I.
6. Ljapunov's direct method II.
7. Problem solving.
8. Written exam. The Routh-Hurwitz criterium.
9. Stability of systems with constant coefficients.
10. Method of linearization I.
11. Method of linearization II.
12. Applications in Physics and Engineering I.
13. Applications in Physics and Engineering II.
14. Applications in Mathematical Systems Theory.
15. Written exam.

**School of Mechanical Engineering**
**Department of Automotive and Thermal Technologies**

*Course title*
## BASIC THEORY OF AGRICULTURAL TRACTORS AND OFF-ROAD VEHICLES
ECTS Credit: 3
*Instructor*
**Lajos LAIB, Professor**

### Overview

The course provides a detailed analysis of the theory of off-road vehicles, including farm tractors. The relationship between soil and vehicle is discussed, as well as the theory of drawbar pull generation, various losses and the basics of vehicle suspension design. This course enables the student to perform the technical evaluation of cross-country vehicles. This course uses the material taught in the following basic subjects: mechanics, machine elements and soil science.

### Topics of the course

1. The role and significance of off-road mobility theory. The history of off-road locomotion, traffic and transportation.
2. Soil and terrain characteristics. Evaluation of soil and terrain from the viewpoint of off-road locomotion. Classification of soils. Classification systems. General soil parameters. Parameters for quantifying trafficability.
3. Tests needed for the development of mobility theory. Methods and test equipment. Soil and terrain parameters, test apparatuses. Discussion of testing methods.
4. Analysis of running gear - soil interaction. Modeling of the interaction. Empirical, semi-empirical and theoretical approximations.
5. Rolling resistance. Kinematics of wheels and tracks. Static analysis of the forces, the type and magnitude of the resistances. Determination of Drawbar pull (DP), and Rolling Resistance (RR). Analysis of steering and directional control of towed and driving wheels.
6. The relationship between pneumatic tires and soil. The particulars of a rolling tire. Tire deformation and its quantitative determination. Selection of an appropriate tire. Special tire constructions.
7. The development of traction. The mechanics of tracks and driving wheels. Determination of the peripheral force by means of empirical, semi-empirical means as well as the soil mechanics approach.
8. The biomechanical effect of moving over plow-fields. Determination of contact pressure for wheeled and tracked vehicles. The effect of running gears on plow fields The effect of soil compaction on plant development and yield. Prevention of soil compaction.
9. Vehicle mobility. The concept of mobility. The basics mobility modelling.
10. Determination of the parameters needed for mobility modelling.
11. Negotiation of macro obstacles. The mathematical description (simulation) of obstacle negotiation.
12. Vehicle vibrations. Dynamic effects influencing vehicle vibration.
13. Terrain and road-profile as the excitation function generating vehicle vibrations. Vertical acceleration as a function of terrain profile and vehicle velocity. Consultations. Colloquium.
14. Classification of tractors and their critical evaluation. Dynamic properties of tractors. Computation of their stability. The performance balance of tractors.
15. Vehicle dynamics. Differential equations of motion. Pull and performance requirements for on-road vehicles.
16. Written and oral exam.

**School of Mechanical Engineering**
**Department of Mechanical Engineering Technology and Maintenance of Machinery**

*Course title*
**MATERIAL SCIENCE**
ECTS Credit: 4
*Instructor:*
**Lajos PELLÉNYI, Associate Professor**

**Overview**

The course presupposes basic knowledge of structures of metals and their alloys; metallography; heat treatment of steels; material testing; knowledge of steels, cast-irons; Al-alloys; copper-alloys. Laboratory-exercises are included in the field of material testing.

**Topics of the course**

1. Most important atomic-structures.
2. Lattice defects (dislocations, etc.).
3. The structure of metal-alloys.
4. Basic equilibrium-diagrams.
5. Iron-carbon equlibrium diagrams.
6. The theory of the heat-treatment of steels (T.T.T.-diagrams).
7. Heat treatment processes (Annealing-technologies; Normalizing,Quenching and Tempering; Carburizing; Cyaniding; Nitriding).
8. The practice of heat-treatment technologies.
9. Destructive material-testing (Tensile-test; shear-test; hardness-tests: Brinell, Vickers, Rockwell; Poldi; Charpy-test; brittle-fracture tests; fatigue-tests; technological-tests; microscopic-test.).
10. Non-destructive material-testing (X-ray-test; ultrasound, magnetic-test etc.).
11. Basic knowledge of steels (construction steels; tool-steels; special-steels.).
12. Basic knowledge of cast-irons (gray; malleable cast irons).
13. Basic knowledge of Al-alloys (Casting alloys; wrought-alloys).
14. Basic knowledge of copper-alloys (Bronzes; brasses).

**School of Mechanical Engineering**
**Department of Mechanical Engineering Technology and Maintenance of Machinery**

*Course title*
## MECHANICAL ENGINEERING TECHNOLOGY I.
ECTS Credit: 3
*Instructor*
**Lajos PELLÉNYI, Associate Professor**

### Overview

To study this subject the course Material Science has to be previously completed. The course presupposes basic knowledge of measuring; casting; welding; forging; rolling; cold-forming technologies such as bending; deep-drawing; blanking; spark machining.
Projects are done in the field of welding and blanking.

### Topics of the course

1. Linear measuring; angle measuring; tests of truennes of shape; tests of surface roughness; measuring threads; tests of gears; gauges.
2. Furnaces for casting; moulding; casting-technologies.
3. Weldability of steels; Al-alloys; copper alloys.
4. Hand arc welding. TIG-welding; MÍG/MAG-welding; sub-merged-arc welding; seam welding; butt welding. Plasma-cutting; flame cutting.
5. Theory of the plastic deformation of metals and alloys.
6. Forging-technologies: die-forging; machines for forging; special forging technologies.
7. Rolling-technologies. Pipe-rolling.
8. Sheet-bending technologies. Deep-drawing technologies.
9. Desingning blanking dies.
10. Special cold-forming technologies.
11. Spark machining technologies.

**School of Mechanical Engineering**
**Department of Mechanical Engineering Technology and Maintenance of Machinery**

*Course title*
## MECHANICAL ENGINEERING TECHNOLOGY II.
ECTS Credit: 3
*Instructor*
**Lajos PELLÉNYI, Associate Professor**

### Overview

To study this subject Mechanical Engineering Technology I. has to be previously completed. The course provides basic knowledge of the theory of machining ( turning; drilling; milling; grinding; shaping; tooth cutting etc.); lathe-tools; drills; milling-tools; etc.
After this the students will learn about the lathe – drilling – milling – grinding – gear – tooth milling machines. During pratical lessons they will learn the operational planning of different parts. The basic knowledge of CAM.

### Topics of the course:

1. The theory of turning. Basic lathe-tools (material; shape; etc.). The structure of centre lathes and their accessories. Special lathe machines.
2. The theory of drilling; reaming. Basic types of drills and reamers. Special drills and reamers. The structure of bench drilling machines; drill presses; radial drilling machines.
3. The theory of milling. Basic types of milling-tools. The structure of universal horizontal and vertical milling machines and their accessories.
4. The theory of shaping. Basic types of shaping-tools. The structure of planers. The theory of slotting. The structure of slotting machines.
5. The theory of grinding. The materials of grinding wheels. The basic types of grinding wheels and grinding machines.
6. The theory of tooth cutting and broaching. Basic tools and machines for tooth cutting and broaching. The theory of honing; superfinishing and lapping.
7. The basic structure of NC – machine tools. Programming the NC – machine tools. Tools for NC-machine tools.
8. The basic theory of CAM.

**School of Mechanical Engineering**
**Institute of Process Engineering**

*Course title*
## ELECTRICAL MEASUREMENT OF MECHANICAL QUANTITIES
ECTS Credit: 3
*Instructor*
**Károly PETRÓCZKI Associate Professor**

### Overview

The aim of the subject is to give a theoretical and practical introduction into the electrical measurement of mechanical quantities: strain, mass, force, torque, pressure, displacement, and acceleration. The subject is focused on the sensors of the mechanical quantities especially to the strain gages, measuring circuits and measuring amplifiers. The subject is completed by a presentation of the digital measuring system and a measuring and data processing software. The course is based on pre-study of Stress Analysis and Electronics.

### Topics of the course

1. Fundamentals and general principles of strain gages 1.
2. Fundamentals and general principles of strain gages 2.
3. Strain gage circuits and measuring amplifiers
4. Strain gage bonding exercise 1.
5. Strain gage bonding exercise 2.
6. Force transducers
7. Load cells, electronic scales
8. Torque transducers and its calibration
9. Pressure transducers
10. Inductive displacement and acceleration transducers
11. Piezoelectric transducers and charge amplifiers
12. Digital measuring system (HBM Spider8)
13. Measuring and data processing software (HBM CATMAN)
14. Measuring exercise with measuring system
15. Combined written and oral examination

**School of Mechanical Engineering**
**Department of Agroenergetics and Food Engineering**

*Course title*
## BUILDINGS OF AGRICULTURAL TECHNOLOGIES
ECTS Credit: 3
*Instructor*
**Győző RUDA, Associate Professor**

### Overview

The course is focused on basic knowledge of techniques, building methods. technical drawings. After an overview of natural and manufactured materials and structures the students study the construction and layout of the different production farms. The connection between buildings and technology is underlined.

### Topics of the course

1. Introduction. Investment in countryside.
2. Planning, stages of design, the architectural drawings.
3. The building materials (natural and artificial).
4. Buildings structures (foundations, walls, floors, roofs).
5. Building physics, environmental conditions of farming.
6. Layout and technology of different farms (small and large scale).
7. Buildings of cattle keeping with traditional technologies.
8. Loose housing dairy farms.
9. Pig farms with traditional and large- scale special technologies.
10. Poultry farms (chicken, goose).
11. Buildings for horse keeping.
12. Farms for goat keeping and for other small animals.
13. Storage. Silos, barns, sheds, energy saving storing technologies.
14. Buildings for processing of agricultural-plant products.
15. Processing of animal products. Written exam.

**School of Mechanical Engineering**
**Department of Agroenergetics and Food Engineering**

*Course title*
## ARCHITECTURE OF VILLAGES AND FARMS
ECTS Credit: 3
*Instructor*
**Győző RUDA, Assistant Professor**

### Overview

The course presupposes elementary knowledge of geography, rural environment and architecture. After an overview of all of these the students learn about the management of rural settlements with regard for the technical problems of farms and larger villages within their natural environment and landscape.

### Topics of the course

1. Historical development of rural settlements.
2. Settlement types in the different geographical regions.
3. Network and system of settlements in Hungary.
4. Regional planning and policy, developmental plans.
5. General and detailed arrangement plans.
6. Farms for production and living.
7. Groups of farms. Small villages.
8. Larger villages with central functions.
9. Study tour to farms and rural settlements.
10. Architectural appearance structure and function of rural houses.
11. Traditional and modern architectures in the rural settlements.
12. Building structure and environment. Green areas.
13. Public buildings, cultural monuments, gardens in or near the villages and farms.
14. Supply, services and civil engineering works – roads in countryside.
15. Written exam. Overview and discussion.

**School of Mechanical Engineering**
**Institute of Mathematics and Computer Sciences**

*Course title*
## PARTIAL DIFFERENTIAL EQUATIONS
ECTS Credit:3
*Instructor*
**Zoltán SEBESTYÉN, Associate Professor**

### Overview

The course deals with the most important partial differential equations of mathematical physics, which frequently occur in engineering. First we study the basic concepts and the classification of linear partial differential equations of second order. Then, we discuss various problems with wave, and heat. The Poisson equations are also discussed and solutions given using different methods.

### Topics of the course

1. Review of the basic elements of calculus: differentiation and integration of functions of one and several variables.
2-3. Partial differential equations in Physics: the wave and the heat equation. ThePoisson equation. Partial differential equations. Basic concepts.
4. Classification of second order linear partial differential equations and their canonical form in case of two variables.
5. Classification of second order linear partial differential equations with constant coefficients and their canonical form.
6-7. General principles for the solution of initial value problems in hyperbolic and parabolic case. Written exam. Linear operators. The Fourier transform.
8. Solution of initial value problems for the one dimensional heat.
9. Mixed problems for the heat and wave equations in half-infinite case.
10. The space of square-integrable functions on a given domain. Inner product. Orthonormal systems.
11-14. Eigenvalues and eigenfunctions of linear operators. Symmetric operators. Eigenvalues and eigenfunctions of the Laplace operator.

**School of Mechanical Engineering**
**Department of Agroenergetics and Food Engineering**

*Course title*
## ELECTROTECHNICS
ECTS Credit: 4
*Instructor*
**Péter SEMBERY, Professor**

**Overview**
The course is presupposes previous knowledge of Mathematics and Physics. After an overview of the fundamentals of general electrotechnics, students will learn about electric motors, lighting, electric heating, basic electronics, alarm systems and planning of residential electrical systems. The level of study is suited to needs of mechanical engineer. It doesn't deal with the construction of electrical machines, only with their operation and maintenance.

**Topics of the course**

1. Basic terms and definitions: Atoms and electricity, Electromotive force, Power and energy, Resistance and Ohm's law, Direct and alternating current, Amplitude of sine waves, Phase relations and power in ac circuits, Vector representation of ac waveforms.
2. Resistive networks: Circuit and circuit elements, Series and parallel networks, Combination series – parallel networks.
3. Inductance, capacitance and phase relations: Inductance and inductive reactance, Transformers, Capacitance and capacitative reactance, Combinations of inductance, capacitance and resistance, Power-factor improvement, Power-factor improvement table, Economics of power-factors correction, Simple series RC circuits on dc sources, Simples series RL circuits on dc sources.
4. Power generation and distribution: Production of electrical energy, Generators and alternators, Power transmission, 120/240 V single-phase service system, Three-phase systems, Building service entrances, Electrical grounding, Polarity and switching, Over current protection, Ground fault circuit interrupters.
5. Planning the farmstead distribution system: Demand load for farm buildings, Central metering and distribution, Capacity of main service, Selecting service conductors, Three-phase farmstead services, Phase converters.
6. Planning the residential electrical system: Electrical symbols for plans and blueprints, Placement of outlets and switches, Branch circuits, Sizing the service entrance.
7. Electrical controls: Open-loop and closed-loop systems, Switches and switching circuits, Sensing elements, Combinations of controls, Planning direct control systems, Relay principles, Relay based control systems.
8. Electric motors: Advantages of electric motors, AC motor principles, Single-phase motors, Three-phase motors, Motor terminology and selection, Measurement of motor characteristics, Motor protection and control, Wiring for motor branch circuits.
9. Lighting: Basic concepts of light, Types of light sources, Lighting requirements, Types of lighting systems, Lighting calculations for interior areas, Outdoor floodlighting.
10. Electric heating: Features of electric heating, Resistance heating, Dielectric heating, Induction heating, Arc heating.
11. Solar and wind energy – sources for electricity: Introduction to solar energy, Wind energy, Solar/electrical energy.
12. Introduction to solid state electronics: Semiconductor structure, Semiconductor diodes, Examples diode applications, Diode testing, Transistors, Example transistor applications, Transistor testing and conventions, Thyristors, Integrated circuits.
13. Stray voltage problems: Introductions, Symptoms, Potential stray voltage sources, When can stray voltage be a problem? Standardised measurements, Solutions to the problem, Closure.

**School of Mechanical Engineering**
**Department of Physics and Process Control**

*Course title*
## SENSOR PHYSICS
ECTS Credit: 3
*Instructor*
**István SERES, Associate Professor**

### Overview

The aim of the course is to describe the physical processes and the physical background of the operation of different sensors. The physical processes are described together with their governing equations from which important factors can be deduced. Parallel with the usability of a given sensor, different purposes for different conditions is also discussed. As the sensor is generally an energy converting equipment, the sorting of sensors is based on the type of energy conversion, e.g. thermal to electrical. As general data processing is based on electrical signals the conversion to electrical energy is discussed in great detail. Further information: iseres@fft.gau.hu

### Topics of the course

1. Basics of the information theory.
2. The information stored by different type of energy.
3. General properties of sensors, data logging.
4. The "cube" studied effects.
5. Mechanical-electrical energy conversion.
6. Mechanical sensors.
7. Thermo-electrical energy conversion.
8. Thermo-electrical sensors.
9. Thermocouple.
10. Electro-thermal energy conversion, reversible heats.
11. Magneto-electrical energy conversion and sensors.
12. Electromagnetic radiation sensors.
13. Chemical-electrical energy conversion and sensors.
14. Electromechanical energy conversion.
15. Introducing to complete data logging system.

**School of Mechanical Engineering**
**Department of Physics and Process Control**

*Course title*
## PHYSICS I.
ECTS Credit: 3
*Instructors*
**István SERES, Associate Professor**
**Csaba MÉSZÁROS, Associate Professor**

### Overview

The aim of the course is to provide a basic knowledge of physics for the special subjects of technical higher education. The first part of the two semester course introduces the mechanics of points, rigid bodies and stationary bodies, with the help of the uniform method of mass and impulse balance equations. In the chapter about waves acoustics are stressed. At the end of the semester thermodynamics is introduced. Further information: iseres@fft.gau.hu

### Topics of the course

1. Basic quantities in Physics, calculation with vectors, the SI system.
2. Kinematics.
3. Dynamics of a mass point, the Newtonian laws, inertial forces.
4. Forced motions (slope, curvilinear,…), friction.
5. Conservation of impulse, angular momentum and energy.
6. Physics of the rigid body.
7. Oscillations and mechanical waves.
8. Hydrostatics.
9. Fluid dynamics of ideal liquids.
10. Fluid dynamics of Newtonian liquids.
11. Thermodynamics, foundations of the kinetic theory of gases.
12. Properties of gases, the laws of the thermodynamics.
13. Special changes, heat engines.
14. Thermal expansion, thermodynamical state transitions.
15. Heat conduction, thermal resistance.

School of Mechanical Engineering
**Department of Physics and Process Control**

*Course title*
## PHYSICS II.
ECTS Credit: 3
*Instructors*
**István SERES, Associate Professor**
**Csaba MÉSZÁROS, Associate Professor**

**Overview**

The aim of the course is to provide a basic knowledge of physics for the special subjects of technical higher education. This second part of the two semester course introduces electrodynamics, optics and atomic physics. At the end of the semester some applications of modern physics are introduced. Further information: iseres@fft.gau.hu

**Topics of the course**

1. Coulomb force, electrostatic field of point charge.
2. Gauss law, electrostatic field of continous charge distribution.
3. Electrostatic potential, potential fields, potential energy.
4. Condensators.
5. Constant current circuits.
6. Magnetic field, Biot-Savart law.
7. Moving of the charged particles in the magnetic field, the Lorentz force.
8. Electromagnetic induction, alternate current.
9. RLC circuits, electromagnetic waves.
10. Geometrical optics.
11. Physical optics.
12. Atomic physics, basics of the quantum physics.
13. Nuclear physics, dosimetry.
14. Astrophysics, nuclear reactions in the stars.
15. Applications of the modern physics.

**School of Mechanical Engineering**
**Institute of Farm Machinery**

*Course title*
**INTRODUCTION TO MACHINE ELEMENTS DESIGN.**
ECTS Credit: 4
*Instructor*
**István SZABÓ, Associate Professor**

**Overview**

The course provides a basic knowledge of designing elements of machines. The main objective is to develop (in the junior mechanical engineering student) the ability to analyse operational principles of different machine elements, with special emphasis on their design, using simple mechanical models and formulas. Further information : szaboist@mgi.gau.hu

**Topics of the course**

1. Introduction to machine design, mechanical models (stresses, fatigue failure).
2. Design of soldering and riveted joints.
3. Design of welding.
4. Design of joining and power screws.
5. Design of springs and other supporting elements.
6. I. test (written).
7. Discussion of the homework(s).
8. Theory of shafting.
9. Shaft-hub joints.
10. Design of solid couplings.
11. Design of flexible couplings.
12. Design of brakes.
13. Design and elements of pipelines.
14. II. test (written).
15. Summary, discussion of exam.

**School of Mechanical Engineering**
**Department of Heating-, Saniter- and Environment Engineering**

*Course title*
## SOLAR ENGINEERING
ECTS Credit: 4
*Instructor*
**Márta SZABÓ, Associate Professor**

### Overview

The course presupposes basic knowledge in the use of renewable energy sources. After an overview of solar geometry, students will learn about the meteorological and climate criteria of using solar radiation. Different solar systems with sizing and economic will be discussed based on the different types of solar energy used (active-passive, heating, cooling and photovoltaic). Visiting a company to study the production of solar applications is included.
Further information: szabo@MGK.gau.hu

### Topics of the course

1. The Sun as an energy source, the solar resource.
2. Geometry of solar radiation.
3. Effect of climate and meteorological parameters in use of solar energy.
4. Passive solar heating, Building heating.
5. Solar thermal systems, Active Solar heating.
6. Non concentrating systems, structure of flat collectors and structure of solar water heating system.
7. Solar cooling; Concentrating systems.
8. Written exam. Review and discussion of exam.
9. Photovoltaic use of solar energy.
10. Storage systems.
11. Sizing of solar equipment.
12. Solar process economics.
13. Industrial and agricultural use of solar energy.
14. Visit of a firm producing solar collectors.
15. Written exam. Overview and discussion of exam.

**School of Mechanical Engineering**
**Department of Systems Engineering and Machinery Management**

*Course title*
**FLUID MECHANICS**
ECTS Credit: 4
*Instructor*
**Ferenc SZLIVKA, Associate Professor**

**Overview**

This course is an introduction to fluid statics, kinematics and dynamics, for students of mechanizal engineering. The main mathematical requirements are the simple methods for solving differential equations and using vector- and scalar-functions. First of all the course will describe the basic physical properties of fluid flow behaviour, the balance equations of fluid and the general equations of motion (Euler's- Bernoulli's and momentum equations). After having learned the basic equations, we will solve some cases, which are important in everyday practice. The course will also describe measurement systems and devices which are used in fluid mechanics, like manometers, velocity probes, Venturi-meters etc.www.mgk.gau.hu/_szlivka. Further information: szlivka.gurt@mgk.gau.hu

**Topics of the course**

1. Liquids and gases. Units of mass force pressure, density etc. Definition of pressure, vapour pressure, cavitation.
2. Basic equation of hydrostatic. Liquid in equilibrium. Types of manometers.
3. Euler's equation, Bernoulli's equation
4. Application of Euler's and Bernoulli's equations,
5. Prandtl- and Pitot tube, Venturi-meter, simple pumps.
6. Euler turbine equation applied for a radial flow fan. The characteristic curves of fans and pumps.
7. Linear momentum equation.
8. Application of momentum equation. Pelton turbine, propeller, windmill etc.

9-10. Friction flow. Reynolds' experiment. Laminar and turbulent flow. Reynolds number. Navier-Stokes equation. Darcy-Weissbach's law for pipe flow.

11-13. Nikuradse and Moody chart. Three type of pipe problems. Pressure loss in a straight pipe and minor losses in different fittings. Hydraulic calculation of a network system. Compressible friction fluid flow in a long straight pipeline.

**School of Mechanical Engineering**
**Department of Agroenergetics and Food Engineering**

*Course title*
**GREEN ARCHITECTURE**
Credit: 3
*Instructor*
**Miklós SZŰCS, Scientific Research Fellow**

**Overwiew**

This course gives a comprehensive intoduction into topics of green architecture. The energy-efficient approach of the course is innovative, present realized examples and applications.

Topics of the course

1. Introduction. Concepts of green architecture.
2. Vernacular architecture in Hungary.
3. Climate-responsive residential and rural architecture.
4. Green materials, constructions, technologies.
5. Traditional and new earth constructions.
6. Traditional and new timber constructions.
7. Green facades.
8. Green roofs, earth covered houses.
9. Energy-efficient buildings, autonomous houses.
10. Passive solar design and constructions.
11. Active and hybrid solar systems.
12. Low-cost buildings.
13. Building biology. „Sick building" syndrome.
14. Eto-farms.
15. Eco-villages.

**School of Mechanical Engineering**

**Department of Agroenergetics and Food Engineering**

***Course title***

**Bases of energetics**

ECTS Credit: 3

***Instructor***

**László TÓTH, Professor**

**Overview**

In the frame of the subject, the technical knowledge in connection with the energy production and supply will be mainly reviewed such as the fundamental concepts of the energy production and supply, the dominant energy kinds and energy carriers (agents), primary and secondary energy carriers, energy transformers, electric drives as well as the main constructional units of the power-plant systems – fuel preparatory plants, energy converters, heat exchangers, electric heaters, boilers etc. – and the basic devices of renewable energy sources – the basic units of renewable-power (biomass, solar, wind, geothermal) plants, their operation and technical properties.

**Topics of the course**

1 Basic primary and secondary energy carriers and their main properties

2 Power stations based on conventional energy carriers; main versions according to the energy carriers

3 Electric energetics – fundamental concepts and knowledge

4 Electric mains, power-network systems

5 Production of electric energy and its devices; electric machines and drives, system elements of electric industry; protecting devices

6 Electric energy management

7 Energetic-purpose use of the biomass; raw materials (exploitation, transport, storage, preparation), utilization (burning, oil production, estering conversion, alcohol production, biogas)

8 Utilization of solar energy (thermal, electric); the main systems, advantages, improvement requirements

9 Utilization of the wind energy – estimation of the energy potential, devices and systems of the generating of electric and mechanical energy

10 Geothermal energy; power-plant and decentralized heat supply systems

11 Hydro-energy; special devices of energy utilization

12 Heat- and electric-energy converters (heat pumps, air conditioning devices)

13 Storage of energy (facilities of accumulation, main forms, development trends)

14 Energy management; facilities and systems of energy saving

**School of Mechanical Engineering**
**Department of Mathematics**

*Course title*
## MATHEMATICAL SYSTEMS THEORY
ECTS Credit: 3
*Instructor*
**Zoltán VARGA, professor**

### Overview

Presupposing prior completion of the courses entitled Mathematics IV, Ordinary Differential Equations and Stability Theory, this course deals with the basic concepts and theorems of the theory of linear continuous-time; as well as, discrete time systems, with applications to basic systems-theoretical models of engineering. Further information: zvarga@mszi.gau.hu

### Topics of the course

1. Examples of continuous-time and discrete-time dynamical systems.
2. *n*-dimensional linear systems.
3. Stability concepts and theorems for discrete time dynamical systems.
4. Control and observation systems.
5. Application of Laplace transform. Transfer function of a system.
6. Controllability of linear continuous-time systems.
7. Observability of linear continuous-time systems.
8. Written exam.
9. Equivalence of linear control-observation systems.
10. Controllability and observability of linear discrete-time systems.
11. Feedback and stabilization.
12. Nonlinear control and observation systems.
13. Optimality of control systems.
14. Identification and realization of systems.
15. Written exam.

**School of Mechanical Engineering**
**Department of Mathematics**

*Course title*
## MATHEMATICS IV.
ECTS Credit: 3
Instructor
**Zoltán VARGA, professor**

### Overview

The course is aimed at providing a completion to the basic courses Mathematics I-III, dealing mainly with the basic chapters of Complex Analysis, to be applied in courses on differential equations, mathematical systems theory and in various subjects of engineering.
Further information: zvarga@mszi.gau.hu

### Topics of the course

1. Complex functions and transformations of the plane. Stereographic projection.
2. Complex series, power series and elementary functions.
3. Continuity and differentiability of complex functions. Basics of differential calculus of complex functions.
4. Cauchy-Riemann differential equations.
5. Comform mappings and their applications.
6. Complex line integral I.
7. Complex line integral II. Written exam.
8. Cauchy's Fundamental Theorem and its corollaries.
9. Liouville's theorem. The Fundamental Theorem of Algebra.
10. Laurent series. The residue theorem and its applications.
11. Laplace transform I.
12. Laplace transform II.
13. Surfaces of the second order I.
14. Surfaces of the second order II.
15. Written exam.

**School of Mechanical Engineering**
**Department of Agroenergetics and Food Engineering**

*Course title*
## FOOD ENGINEERING
ECTS Credit: 3
*Instructor*
**Tibor VÁRSZEGI, Assistant Professor**

### Overview

Contemporary food industry produces thousands of foodstuffs. The manufacturing technology is slightly different, but the processing steps are basically common for each of them. The course introduces the main units of operations and the machinery of food processing and preservation. Their effect on food quality and consumer - appeal factors are also discussed.
Further information: varszegi.tibor@gek.szie.hu

### Topics of the course

1. Unit operations of food processing and preservation. Principles of food safety and quality.
2. Physical states and properties of materials.
3. Hydrodynamics of Newtonian and Non-Newtonian fluids.
4. Stabilisation and destabilisation of dispersions.
5. Operation and machinery of homogenisation.
6. Operation and machinery of separation.
7. Thermodynamics of steady -state and unsteady-state heat transfer.
8. Process and machinery of pasteurisation and sterilisation.
9. Process and machinery of cooling and freezing.
10. Process and machinery of evaporation.
11. Principles of steady-state and unsteady-state mass transfer.
12. Process and machinery of drying.
13. Process and machinery of membrane separation.
14. Principles of food packaging.
15. Written exam. Overview and discussion of exam.

## Text


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