

## Department of Applied Chemistry and Microbiology 2009-2010

### **Basic Course in Gene Technology ( BIOT200) 2 cp / 1 cu**

850011

#### **Literature :**

Brown, T. A. (2006) *Gene cloning and DNA analysis an introduction*

Horton, R. H., Moran, L. A., Scrimgeour K. G., Perry, M. D., Rawn J. D. (2006) *Principles of biochemistry*

**Timing:** Spring term, period III

**Preceding studies:** YKEM100 or corresponding knowledge required, BKEM100 or corresponding knowledge recommended

**Objective:** An introduction to nucleic acids and to biological information flow. The underlying theory and the various procedures of gene cloning, DNA sequencing, hybridization, and PCR methods. Applications, ethics and laws related to gene technology are treated briefly.

**Contents:** The central dogma of molecular biology and the principles of regulation of gene expression are studied in the beginning of the course. The students will become acquainted with how to produce and analyse recombinant DNA molecules. Especial attention will be paid to the mode of action of the enzymes capable to modify nucleic acids. DNA sequencing, PCR amplification and hybridization techniques will be taught. The area of applications as well as the questions related to ethics and gene technology legislation will be taken up shortly during the course.

#### **Study materials and literature:**

- T.A.Brown. 2006. Gene Cloning & DNA Analysis An Introduction (5. painos)
- Horton. H. R., Moran. L. A., Scrimgeour. K. G., Perry. M. D., Rawn. J. D. 2006. Principles of Biochemistry (4. painos) (applicable parts)

**Completion:** The first examination is organized at the end of the course, two retakes will take place at the general examination days of the division Chemistry and Biochemistry. Lectures 20, independent study 33 hours

**Responsible person:** University Lecturer Kristiina Mäkinen

**Other information:** The language of instruction is Finnish, but the course can be taken as a literature examination in English. Registration to examinations is done on WebOodi at latest one week prior to examination date.

### **Laboratory Course In Gene Technology 3 cp / 2 cu**

850012

**Timing:** Spring term, period IV

**Preceding studies:** BIOT200 must be attended, YKEM101 required, or corresponding knowledge

**Objective:** The course gives readiness to use the basic methods utilized in molecular biology and biotechnology laboratories.

**Contents:** Amplification of DNA by PCR, the various steps of gene cloning, purification and electrophoretic analysis of DNA.

**Study materials and literature:** Course handout

**Completion:** Course report Practical work 56, independent study 27 hours

**Responsible person:** University Lecturer in Applied Biochemistry and Molecular Biology

**Other information:** Language of instruction is Finnish, but instruction of one group is arranged in English when needed. Registration to course is done on WebOodi.

Registration is binding. The number of students taken to the course is limited.

### **Biochemistry I (BKEM100) 5 cp / 3.5 cu**

850006

#### **Literature :**

Horton, R. H., Moran, L. A., Scrimgeour K. G., Perry, M. D., Rawn J. D. (2006)  
*Principles of biochemistry*

**Timing:** Spring term, period IV

**Preceding studies:** YKEM100 or corresponding knowledge required

**Objective:** An introduction to the structure and function of the main groups of macromolecules in cells, to biological membranes and to transport. The main ideas of energy metabolism will be covered.

**Contents:** The general structure and main functions of proteins, enzymes, lipids and carbohydrates. Transport and basics of biosignaling in biological membranes. Includes an overview of energy metabolism in cells.

#### **Study materials and literature:**

- Horton. H. R., Moran. L. A., Scrimgeour. K. G., Perry. M. D., Rawn. J. D., 2006, Principles of Biochemistry

**Completion:** The first examination is organized at the end of the course, two retakes will take place at the general examination days of the division Chemistry and Biochemistry. Lectures 40, independent study 93 hours

**Responsible person:** Professor in Applied Biochemistry and Molecular Biology

**Other information:** The language of instruction is Finnish, but the course can be taken as a literature examination in English. Registration to examinations is done on WebOodi at latest one week prior to examination date.

### **Biochemistry I Laboratory Course (BKEM101) 5 cp / 3.5 cu**

85074

**Timing:** Autumn term, period I, II; spring term, period III and IV

**Preceding studies:** YKEM100, YKEM101 and BKEM100 or corresponding knowledge required

**Objective:** Mastery of essential skills and techniques of experimental biochemistry, the ability to perform the requisite calculations and to draw conclusions from the data obtained.

**Contents:** Isolation, purification and characterization of an enzyme; quantitative measurements of proteins and carbohydrates.

#### **Study materials and literature:**

- Course handout
- Boyer. R. F. 1986. Modern Experimental Biochemistry.

**Completion:** Examination and course report Practical work 100, independent study 33 hours

#### **Responsible person:**

- Lecturer in Biochemistry Maija-Liisa Rasilo

**Other information:** The language of instruction is Finnish, but special instruction in English if needed

### **Biochemistry II (BKEM200) 5 cp / 3.5 cu**

850007

#### **Literature :**

Horton, R. H., Moran, L. A., Scrimgeour K. G., Perry, M. D., Rawn J. D. (2006)  
*Principles of biochemistry*

**Timing:** Autumn term, period I

**Preceding studies:** YKEM100 ja BKEM100 or corresponding knowledge required

**Objective:** Learning, how cells get energy from macromolecules and how the monomeric subunits of macromolecules are synthesized.

**Contents:** Biochemical pathways of energy metabolism, biosynthesis of macromolecular precursors, and regulation of the cellular metabolism.

**Study materials and literature:**

· Horton. H. R., Moran. L.A., Scrimgeour. K. G., Perry. M. D., Rawn, J. D., 2006, Principles of Biochemistry.

**Completion:** The first examination is organized at the end of the course, two retakes will take place at the general examination days of the division Chemistry and Biochemistry. Lectures 42, independent study 91 hours

**Responsible person:** Lecturer in Biochemistry Maija-Liisa Rasilo

**Other information:** The language of instruction is Finnish, but the course can be taken as a literature examination in English. Registration to examinations is done on WebOodi at latest one week prior to examination date.

### **Molecular Cell Biology (BKEM300) 5 cp / 3.5 cu**

850008

**Literature :**

Alberts, B., Johnson, A., Raff, M., Roberts, K., Walter, P. (2002) *Molecular biology of the cell*

**Timing:** Autumn term, period II

**Preceding studies:** BKEM100 and BIOT200 or corresponding knowledge required, BKEM200 or corresponding knowledge recommended

**Objective:** The aim of the course is to familiarize participants with the architecture and functions of the various organelles in cells.

**Contents:** Introduction to the lifecycle of proteins starting from their synthesis and targeting until their degradation. The functions of the various cellular organelles and differences between animal and plant cells, as well as biosignaling and interactions between cells, are also covered.

**Study materials and literature:**

· Alberts. B., Johnson. A., Lewis. J., Raff. M., Roberts. K., Walter. P. ,(toim.)(5. painos)Molecular Biology of the Cell, (Garland Science, USA)

**Completion:** The first examination is organized at the end of the course, two retakes will take place. Date and time of the resit examinations will be conveyed in pursuance of the course. Lectures 26, independent study 107 hours

**Responsible person:** Professor of Applied Biochemistry and Molecular Biology

**Other information:** The language of instruction is Finnish, but the course can be taken as a literature examination in English. The course is recommended in the third year of studies. Registration to examinations is done on WebOodi at latest one week prior to examination date. The course is organized in collaboration with the Faculty of Biosciences.

### **Food Chemistry (EK111) 4 cp**

871071

**Timing:** Master studies, 1st year, period III (spring 2009)

**Objective:** Introduction to basics of food chemistry.

**Contents:** Chemical structures of food components and their most important properties and reactions in food. How the different components of food affect its

quality?

**Study materials and literature:** Coultate, T.P., Food, The Chemistry of Its Components, 4th ed. (2002)

**Completion:** Introductory lectures given by prof. Piironen. Independent studying + tutored group work.

**Evaluation:** Literature examination

**Responsible person:** Vieno Piironen

### **Food Legislation and Control (EK131) 5 cp**

871074

**Timing:** Master studies, period I - II, (autumn 2008)

**Objective:** Introduction to food legislation and control systems.

**Contents:** European regulations on food, action of European Food Safety Authority (EFSA,) Food control system in Finnish Food Safety Authority (EVIRA), Finland, case type studies (incl. national and EU legislations), Case study; food control systems in the retail market chains, Control of imported goods, action of Finnish Custom Laboratory

**Study materials and literature:** Material provided during the course.

**Completion:** Lecture series, excursion to EVIRA, Blackboard learning system K30 - H0 - R2 - I100

**Evaluation:** Examination and/or a written essay

**Responsible person:** Velimatti Ollilainen

### **Chemical Risk Factors (EK132) 5 cp**

871072

**Timing:** Master studies, period II, (autumn 2008)

**Objective:** Introduction to the chemical hazards and risks related to foods.

**Contents:** Chemical hazards: structures, reactivity, analytical methods, occurrence in foods or feeds. Significant for human health i.e chemical safety (occurrence, intake, ADI). Environmental aspects. Course deals with heavy metals, POPs, "the Dirty Dozen" compounds, nitrate, allergenes, natural born toxins, medicine residues, food additives, dietary supplements, hazardous compounds derived from food processing or food packaging, pesticide residues.

**Study materials and literature:** Material provided during the course.

**Completion:** Lecture series, Blackboard learning system K40 - H0 - R0 - I92

**Evaluation:** Examination and/or a written essay

**Responsible person:** Velimatti Ollilainen

### **Basic Toxicology and Risk Assessment (EK133) 5 cp**

871073

**Timing:** academic year 2009 -2010

**Objective:** Understanding the principles of safety assessment of food and food ingredients.

**Contents:** Basic principles of toxicology (clinical testing, basic concepts), principles of nutritional physiology, metabolic reactions of chemical risk factors, principles of risk assessment

**Study materials and literature:** Material provided during the course.

**Completion:** Lecture series. K30 - H0 - R10 - I92

**Evaluation:** Examination and/or a written essay

**Responsible person:** Marina Heinonen

### **Vitamins and other bioactive compounds (EK221) 5 cp / 3 cu**

87145

#### **Literature :**

Belitz, H.-D. (2004) *Food chemistry*, oheislukemisto .

**Timing:** period IV (next time in spring 2010), even years only

**Study materials and literature:** Belitz, H.D. & Grosch, W., *Food Chemistry*, Springer Verlag, Berlin. Other relevant literature indicated during the course.

**Completion:** Lecture series, written exercises, K46-H0-R0-I88

**Evaluation:** Examination and a written essay

**Responsible person:** Marina Heinonen

**Other information:** Given only in even years. The lectures will be given in English.

### **Food enzymes (EK222) 3 cp / 2 cu**

87146

**Timing:** Period II, in even years.

**Objective:** To become acquainted with the properties of enzymes, their technological significance and use in food industry.

**Contents:** Properties of food enzymes, principles of enzymatic catalysis, enzyme engineering, enzyme production, industrial enzymes, applications in food industry, legislation.

**Study materials and literature:** Relevant literature indicated during the course.

**Completion:** Lecture series + written essay. K28-H0-R0-I52

**Evaluation:** Examination and a written essay

**Responsible person:** Marina Heinonen

**Other information:** Given in even years only.

### **Food additives (EK223) 3 cp / 2 cu**

87148

#### **Literature :**

Branen, A.L., Davidson, P.M., Salminen, S.J. & Thorngate, J. (1999) *Food additives*

**Timing:** periods II

**Objective:** To get acquainted with the chemical properties and technological function of food additives.

**Contents:** Chemical and functional properties of food additives, their working mechanisms, legislation, safety evaluation, estimation of intake.

**Completion:** Lecture series. K28 - H0 - R0 - I52

**Evaluation:** Examination and a written essay

**Responsible person:** Marina Heinonen

**Relations to other study units:** YKEM100, YKEM101

**Other information:** Given in uneven years only, next time in autumn 2009

### **Research methods (EK331) 8 cp / 6 cu**

87163

**Timing:** Masters studies, 2nd year, period I - II (autumn 2009)

**Objective:** To achieve a profound understanding of analysis methods used in food chemistry. To develop skill needed to successfully carry out the masters thesis.

**Contents:** The course consists of four extensive laboratory exercises including report writing. Topics: 1. Statistical analysis of data of minerals and trace elements analysis carried out by ICP-MS 2. Assaying oxidation in plant oils. 3. Validation of a small

scale separation and analysis method for tocoferols 4. Vitamin E analysis using LC-MS In each exercise an extensive report is written covering the chemistry of the phenomenon in question, the principles of the equipment used, the results and their comparison to literature values. The course covers: validation of chemical analytical methods, expression of measurement uncertainty, using standards and certified reference materials, trueness, precision, repeatability.

**Study materials and literature:** Material provided during the course.

**Completion:** Laboratory work, report writing. K8 - H56 - R0 - I120

**Evaluation:** Reports

**Responsible person:** Velimatti Ollilainen and Anna-Maija Lampi

**Other information:** Laboratory skills and understanding of chromatographic methods required.

### **Practical Training (EK341) 1 cp**

871077

**Timing:** According to agreement

**Objective:** To acquire practical experience in a company, research institute or government agency operating in the field of food safety.

**Contents:** As agreed

**Completion:** Placement in a suitable company or research institute. This should be agreed in advance with the responsible professor. The training should last 12 weeks.

**Evaluation:** To be agreed on before the beginning of the placement. Alternatives: a case book, learning diary or examination.

**Responsible person:** Vieno Piironen or Per Saris

**Other information:** Students are to find the placements for practical training themselves. Practical training can also be integrated with other studies, such as research projects.

### **Master`s Thesis + Maturity Examination (EK351) 40 cp**

871075

**Timing:** Master studies, 2nd year, period I-IV, according to agreement

**Objective:** The thesis should demonstrate the student's ability for scientific thinking, competence in the relevant research methods, familiarity with the topic and proficiency in academic writing.

**Contents:** Completion of an individual laboratory project in the area of food safety. Duration of laboratory work about 3 months and preparation of a coherent, written thesis report book about 2-3 months. The thesis book shall be divided into a review of relevant literature and a detailed report of the laboratory work with results and discussion.

**Study materials and literature:** Current scientific literature relevant to the topic.

**Evaluation:** Thesis book

**Responsible person:** Vieno Piironen or Per Saris

### **Literature Examination (EK361) 5 cp**

871076

**Timing:** Master studies, 2nd year, period I-IV, according to agreement

**Objective:** Profound knowledge on some area of food safety or food bioprocessing

**Contents:** An examination on literature of choice. Literature according to an agreement with the responsible professor. 1 credit/100-150 pages.

**Completion:** Literature examination. I134

**Responsible person:** Vieno Piironen or Per Saris

**Laboratory practical I a (MAA265) 5 cp / 3 cu**

817860

**Timing:** Spring term, Period III

**Objective:** Principles of analytical methods and equipment used in agricultural, environmental and food sciences.

**Contents:** Safety issues of laboratory work. Inorganic analyses of soil, plant and water samples. Written report of the analyses and their results.

**Study materials and literature:**

1. Laboratory manual and
2. parts of L.P. van Reeuwijk (ed.): Procedures for soil analysis. 6. ed. Technical paper 9. ISRIC, Wageningen, The Netherlands.

**Evaluation:** Evaluation of the report. Written examination.

**Responsible person:** University lecturer Eila Turtola.

**Relations to other study units:** Lectures and laboratory practicals of chemistry (YKEM100, YKEM101) and Principles of Soil Science (MAA200, MAA270), or corresponding knowledge.

**Other information:** If foreign students are enrolled, the language of instruction is English; otherwise Finnish. This short course is offered concurrently with the more comprehensive Laboratory Practicals (MAA360). Enrolment in MAA265 is limited. Contact the student advisor for further information.

**Readings I (MAA270) 5 cp / 3 cu**

817834

**Timing:** Certain examination dates in all semesters (3-5 examination dates each semester).

**Objective:** Understanding the principles of soil science and plant nutrition

**Contents:** Written + oral examination

**Study materials and literature:**

1. N.C. Brady & R.R. Weil: The Nature and Properties of Soils. 13. painos. 960 s. Prentice Hall, 2002.

**Evaluation:** -

**Responsible person:** Professor Markku Yli-Halla

**Relations to other study units:** Basic knowledge of chemistry

**Other information:** By passing this literature examination non-Finnish speaking students who have sufficient knowledge of chemistry become eligible to enrol in the Laboratory Practicals of Environmental Soil Science.

**Laboratory practical I (MAA360) 10 cp / 5 cu**

817838

**Timing:** Spring term, Period III

**Objective:** Comprehensive command of analytical methods and equipment used in agricultural, environmental and food sciences.

**Contents:** Safety issues of laboratory work. Inorganic analyses of soil, plant and water samples. The analyses include, among others, the determination of pH and electrical conductivity of soil, soil organic carbon content and particle size distribution, cation exchange capacity, water retention properties of soil, nutrient contents of soil and plant material, and basic water analysis. Written report of the analyses and their results.

**Study materials and literature:**

1. Laboratory manual and
2. L.P. van Reeuvijk (toim.): Procedures for soil analysis. 6. painos. Technical Paper 9. ISRIC, Wageningen, The Netherlands.

**Evaluation:** Evaluation of the report. Written examination.

**Responsible person:** University lecturer.

**Relations to other study units:** Lectures and laboratory practicals of chemistry (YKEM100, YKEM101) and Principles of Soil Science (MAA200 or MAA270), or corresponding knowledge.

**Other information:** If foreign students are enrolled, the language of instruction is English; otherwise Finnish. The number of participants taking MAA360 is limited. Contact the student advisor for further information.

**Soil fertility and plant nutrition for international students (MAA545) 5 cp / 2.5 cu  
817600**

**Timing:** Start of the course in Period II; dead-line for the term papers at the end of Period III. Written exam on the fixed examination days of Environmental Soil Science /Department of Applied Chemistry and Microbiology. The oral exam will be within two weeks after passing the written exam.

**Objective:** This course is arranged principally for the international students enrolling the Masters Programme of Plant Production Sciences (MScPPS). The students get a command of phenomena and processes of soil fertility, chemistry of plant nutrients and fertilizers in soil, losses of plant nutrients and management of soil fertility.

**Contents:** Soil - plant relationships, acidity and alkalinity, plant nutrients and fertilizers, soil fertility evaluation, basics of nutrient management, interaction of nutrients and other growth factors, agricultural productivity and environmental quality.

**Study materials and literature:**

1. Text book: J.L. Havlin, J.D. Beaton, S.L. Tisdale, W.L. Nelson: Soil Fertility and Fertilizers. An Introduction to Nutrient Management. 7. ed. Pearson - Prentice Hall, Upper Saddle River, New Jersey, USA. 515 pp.
2. Material needed for writing the essay (term paper).

**Completion:** The students 1) read the text book with the help of a list of about 150 study questions furnished by the teacher and 2) write individually a 10-15 page essay (term paper) on a topic of their interest. The term paper is based on scientific literature selected and searched by the student. The group of students enrolling this course meets with the teacher 3-5 times during the study process for discussions and feedback.

**Evaluation:** Evaluation of the essay (term paper) (30%). Written and oral examination (70%).

**Responsible person:** Professor Markku Yli-Halla

**Relations to other study units:** The student must have basic knowledge of soil science and plant nutrition. In the first place, this level should have been achieved before registering for the University of Helsinki in the courses available in most agricultural faculties in the world, such as Principles of Soil Science and Plant Nutrition (or its equivalent). Alternatively, the student can obtain this level of knowledge by passing the course MAA270 (Readings I; see above).

**Food Microbiology (MIKRO233) 4 cp  
864988**

**Timing:** Master studies, 1st year, periods I-IV

**Objective:** Basics of food and water microbiology.

**Contents:** Water and food standard methods of analysis, food pathogens, microbiological spoilage of food, fermentation products. Microbiological safety in food production. Microbiological quality of drinking water.

**Study materials and literature:** J.M Jay et al. Modern Food Microbiology, seventh edition. Springer Science + Business media Inc. 2005, NY, USA. Parts I, II, III, V and VI. In addition the materials of the lectures are found on the Blackboard platform.

**Completion:** Literature examination. Corresponding lectures (MIKRO231 period III) are held in Finnish.

**Evaluation:** Literature examination

**Responsible person:** Per Saris

### **Writing an essay in microbiology (MIKRO290) 5 cp / 3 cu**

864063

**Timing:** In basic studies.

**Preceding studies:** MIKRO200

**Objective:** See MIKRO210. To learn scientific writing and to get familiar with the sources of microbiological knowledge.

**Contents:** Introduction to the creation and publication of microbiological knowledge. Use of scientific library and databases, source criticism.

**Study materials and literature:** Scientific microbiological literature.

**Completion:** Independent study.

### **Nova-course Bioinformatics for environmental scientists( MIKRO 520) 3 cp / 1.5 cu**

864981

**Target group:** MSc course, also PhD students are welcome to participate

**Preceding studies:** B.Sc. level education in microbiology, biotechnology etc. - basic knowledge on biomolecular (PCR) methods

**Objective:** Experimental design and subsequent analysis of data in environmental sciences. The course concentrates on data produced by molecular biology methods.

**Contents:** Lectures and use of computer programs

**Study materials and literature:** Material given during the course

**Completion:** Lectures, practicals, own work

**Responsible person:** Kristina Lindström

**Other information:**

<http://www.helsinki.fi/soilsoc/courses/coursesSoilSoc/2008bioinform.html>

### **Food and Environmental Hygiene and Control (MIKRO576) 5 cp**

864989

**Timing:** Master studies, periods I-IV

**Objective:** Basics of hygiene and food control.

**Contents:** Epidemiological studies, food control in Finland and elsewhere, hygiene, selfcontrol, HACCP, certificate of hygiene skills, water, environmental and food standards, food, zoonotic and environmental pathogens, isolation and typing of pathogens.

**Study materials and literature:** J.M Jay et al. Modern Food Microbiology, seventh edition. Springer Science + Business media Inc. 2005, NY, USA. Parts IV, VI and VII. In addition the materials of the lectures are found on the Blackboard platform.

**Completion:** Literature examination. Corresponding lectures (MIKRO575 period II,

autumn 2009) are held in Finnish.

**Evaluation:** Literature examination

**Responsible person:** Per Saris

### **Project Work in Food Chemistry (EK136) 1-4 cp**

87129

**Timing:** periods I-IV, according to agreement

**Objective:** To learn the different steps of research work.

**Contents:** To devise a research plan, to carry out the work according to the approved plan and to report the results. Laboratory work for 4-6 weeks is primarily supervised and performed in one of the research groups at the Division of Food Chemistry.

**Completion:** Laboratory work

**Evaluation:** Laboratory notebook + written report

**Responsible person:** Vieno Piironen

### **Nutritional Science (RAV080) 3 cp**

882037

**Timing:** Master studies, 1st year, period IV (spring 2009)

**Objective:** Introduction to human nutrition

**Contents:** Basic nutritional physiology, energy metabolism, nutrients, nutrition and health

**Study materials and literature:** Gibney MJ, Vorster HH, Kok FJ: Introduction to human nutrition. Blackwell Publishing, 2005.

**Completion:** 2-3 lectures. Independent studying + tutored group work.

**Evaluation:** Literature examination

**Responsible person:** Christel Lamberg-Allardt

### **Working in Research Group (MKRO590) 5 cp / 2-6 cu**

86493

**Timing:** Recommended as a part of Master's studies.

**Objective:** To learn independent working as a member of research group.

**Contents:** Laboratory work for 4-6 weeks is primarily supervised and performed in one of the research groups at the Division of Microbiology.

**Completion:** Study and laboratory work plan, independent laboratory work as a member of research group, writing of laboratory notebook and final research report.

**Evaluation:** Accepted delivery of laboratory notebook and research report.

**Responsible person:** Per Saris, Annele Hatakka, Kristina Lindström, Taina Lundell, Kaarina Sivonen.

**Relations to other study units:** Bachelor's degree and MIKRO510 or equivalent.

**Other information:** The student contacts the leader of the research group of interest. A detailed study and research plan is to be accepted by the professor in microbiology prior to starting of the laboratory work. Student advisor in microbiology will give detailed instructions on planning and reporting instructions.

### **Chemistry, Lectures (YKEM100) 8 cp / 5 cu**

85011

**Literature :**

Chang, Raymond (2006) *General chemistry the essential concepts*

McMurry, John (2003) *Fundamentals of organic chemistry*

**Timing:** Autumn term, period I/II

**Objective:** Basics in general, inorganic and organic chemistry

**Contents:** Inorganic chemistry covers basic concepts in chemistry, structure and properties of elements / compounds, information obtained from the chemical formulas and reactions, different chemical bonds and interactions, reaction types, equilibrium reactions, concepts of pH and buffer, reaction kinetics and heat, and basic calculations in chemistry. Organic chemistry covers basic concepts in organic chemistry, structures of essential functional groups and compounds in organic chemistry and biochemistry, naming, reactivity and physical properties of organic compounds.

**Study materials and literature:**

- General and inorganic chemistry: Chang. R. General Chemistry-The Essential Concepts.
- Organic chemistry: McMurry. J. Fundamentals of Organic Chemistry.
- Theory practices: YKEM100 Teoriaharjoitukset (in Finnish).

**Completion:** The course has two exams, which both need to be passed during the same academic year. Additional points can be gained from the weekly 5 min – tests (1 point / test). The programmable calculators are not allowed in the exams. Book exams

**Responsible person:** Professor Maija Tenkanen

**Other information:** Lectures given in Finnish. English speaking students have book exams.

### **Chemistry, Laboratory Course (YKEM101) 5 cp / 3.5 cu**

85012

**Timing:** Spring term period III or IV

**Objective:** Basic working methods, with an emphasis on quantitative methods

**Contents:** Inorganic and organic laboratory experiments. Principles of qualitative and quantitative analytic methods.

**Study materials and literature:** Course handout

**Completion:** Work examination and course report Practical work 66, independent study 67 hours

**Responsible person:** Full Time Teacher Oili Toivonen

**Other information:** The language of instruction is Finnish

### **Physical Chemistry, Lectures (YKEM110) 6 cp / 4 cu**

85043

**Literature :**

Chang, Raymond (2000) *Physical chemistry for the chemical and biological sciences*

**Timing:** Spring term, period III/IV

**Preceding studies:** YKEM100 or corresponding knowledge required

**Objective:** Familiarize with essential natural laws in chemistry and the mathematical discussion about these laws

**Contents:** An introduction to the principles of kinetic theory of gases, thermodynamics, character of solutions, chemical equilibrium, chemical kinetics and electrochemistry

**Study materials and literature:**

- Chang. R. 2000. Physical Chemistry for Chemical and Biological Sciences. University Science Books. (in part).

**Completion:** Two mid-course examinations. Three retakes an examination each.

Pass the course: 50% of the combined maximum points of the mid-course examinations. Lectures 42, practical work 12, independent study 82 hours

**Responsible person:** University Lecturer Päivi Ekholm

**Other information:** Lectures given in Finnish, handout of lectures available in Blackboard (in Finnish).

### **Applied organic chemistry (YKEM200) 6 cp / 4 cu**

850004

#### **Literature :**

McMurry, John (2004) *Organic chemistry*

**Timing:** Autumn term, period I/II

**Preceding studies:** YKEM100 or corresponding knowledge required

**Objective:** Introduction to the reactions, reaction mechanisms and behaviour of organic molecules and functional groups. Transport effects and behaviour of organic matter in the environment are also covered.

**Contents:** The structure of organic molecules and functional groups. Their polar bonds, reactions and reaction mechanisms. Synthesis, use and behavior of organic functional groups.

#### **Study materials and literature:**

- McMurry, J. 2004. *Organic Chemistry*. Brooks/Cole, or similar other text book of organic chemistry.
- Self searched material
- Course handouts

#### **Completion:**

- Teamworks, exercises and learning portfolio
- The course can be taken as a literature examination in English
- Lectures 22, group work 35, independent study 103 hours

**Responsible person:** University Lecturer Liisa Virkki

**Other information:** Lectures given in Finnish. In the course the problem based learning method is used. This requires active participation in the weekly teamworks and self searching for data.

### **Spectrometry, Lectures (YKEM210) 3 cp / 2 cu**

85045

#### **Literature :**

Pavia, Donald L. (2001) *Introduction to spectroscopy a guide for students of organic chemistry*

**Timing:** Spring term, period IV

**Preceding studies:** YKEM100 ja YKEM101 or corresponding knowledge required

**Objective:** The principles of spectroscopic methods (UV, IR, NMR, MS, ASS) and reading the spectra

**Contents:** The principles of spectroscopy, measuring methods (UV, IR, NMR, MS, AAS) and their applications are studied including exercises of interpretation of spectra.

#### **Study materials and literature:**

- Pavia. D.L., Lampman. G.M. & Kriz. G.S. 2001. *Introduction to spectroscopy*.
- Course handouts.

**Completion:** Final examination; can be taken in English. Lectures 30, independent study 50 hours

**Responsible person:** University Lecturer Liisa Virkki

**Other information:** Lectures given in Finnish

### **Organic Structural Analysis (YKEM211) 4 cp / 3 cu**

85035

**Timing:** Spring term, period III

**Preceding studies:** YKEM101, YKEM200, YKEM210 and YKEM220, or corresponding knowledge required

**Objective:** An introduction to the instruments, equipment and reagents used in organic analytical work, and safety precautions. The isolation, purification and structural analysis of unknown organic compound

**Contents:** The isolation of unknown organic compound from biological material. Chromatographic purification methods: TLC, GC, Flach chromatography. Identification of the compound by spectroscopic methods: IR, NMR and MS.

**Study materials and literature:** Course handouts

**Completion:** Accepted report Practical work 60, independent study 47 hours

**Responsible person:** University Lecturer Liisa Virkki

**Other information:** The language of instruction is Finnish, but special instruction in English if needed

### **Chromatography, Lectures (YKEM220) 3 cp / 2 cu**

85046

**Literature :**

Riekkola, Marja-Liisa (2002) *Kolonnikromatografia ja kapillaarielektromigraatiotekniikat*

**Timing:** Spring term, period III

**Preceding studies:** YKEM100 and YKEM101 or corresponding knowledge required

**Objective:** The objective is to understand the principles of the chromatography.

**Contents:** An introduction to the principles of chromatographic separations and chromatographic techniques and instruments (TLC, GC, HPLC, CE)

**Study materials and literature:**

- A. Braithwaite and F.J. Smith 1996 Chromatographic Methods 5th edition
- Material which is given in the course

**Completion:** Accepted performing of given tasks or final examination Lectures 30, group work 20, independent study 30 hours

**Responsible person:** University Lecturer Päivi Tuomainen

**Other information:** Lectures given in Finnish. The course consists of lectures, the article summary which is done as pair working and teaching portfolio. Final examination is available in English.

### **Gas Chromatography (YKEM221) 2 cp / 1.5 cu**

85053

**Literature :**

Riekkola, Marja-Liisa (2002) *Kolonnikromatografia ja kapillaarielektromigraatiotekniikat*

**Timing:** Spring term, period III or IV

**Preceding studies:** YKEM100, YKEM101, and YKEM 220 or corresponding knowledge required

**Objective:** The objective is to introduce the student in the analytical working with gas chromatography instrument, to determination of chromatographic parameter and to maintain the instrument and to do simple service operations.

**Contents:** An introduction to practical capillary gas chromatographic work and optimisation of gas chromatographic separation.

**Study materials and literature:**

- A. Braithwaite and F.J. Smith. 1996. Chromatographic Methods 5th edition.
- Material which is given in the course.

**Completion:** Examination of the course material and report Practical work 33, independent study 20 hours

**Responsible person:** University Lecturer Päivi Tuomainen

**Other information:** The language of instruction is Finnish or English. The course will be arranged as an intensive course, which lasts for one week.

**Liquid Chromatography (YKEM222) 2 cp / 1.5 cu**

85054

**Literature :**

Riekkola, Marja-Liisa (2002) *Kolonnikromatografia ja kapillaarielektromigraatiotekniikat*

**Timing:** Autumn term, period I or spring term, period IV. The course will be arranged as an intensive course, which lasts for one week.

**Preceding studies:** YKEM100, YKEM101, and YKEM 220 or corresponding knowledge required

**Objective:** The objective is to introduce the student in the analytical working with liquid chromatography, to determination of chromatographic parameter and to maintain the instrument and to do simple service operations.

**Contents:** An introduction to practical reverse and normal phase liquid chromatographic work and optimisation of separation

**Study materials and literature:**

- A. Braithwaite and F.J. Smith 1996 Chromatographic Methods 5th edition.
- Material which is given in the course.

**Completion:** Examination of the course material and report Practical work 33, independent study 20 hours

**Responsible person:** University Lecturer Päivi Tuomainen

**Other information:** The language of instruction is Finnish or English

**Biorefineries (YKEM410) 5 cp / 3.5 cu**

850029

**Timing:** Spring term, period IV

**Preceding studies:** Bachelor degree or corresponding knowledge

**Objective:** To give an overview on present and future on agro- or forestry-based biorefineries and their value-chains with a special emphasis on biotechnology.

**Contents:** The focus is on biotechnical methods and processes, but also other relevant methodologies are reviewed (background and drivers, chemistry and biotechnology of raw materials, bioenergy and biofuels, and various biorefinery concepts in agriculture and forestry).

**Study materials and literature:** Lecture material, articles on the topics

**Completion:** Examination after the course, two retakes Lectures 24, independent study 100 hours

**Responsible person:** Professor Liisa Viikari

**Other information:** Joint course with HUT, lectures in Viikki and Otaniemi (detailed information later). The course will be held in English (or Finnish depending on the attending students)

**Biofuels (YKEM420) 5 cp / 3.5 cu**

850030

**Timing:** Autumn term, period I

**Preceding studies:** Chemically or biotechnically oriented bachelor degree or corresponding knowledge required

**Objective:** To give an overall insight into biotechnical methods for the production of biofuels from renewable resources. Biofuels include ethanol, butanol, biodiesel-oils, hydrogen and methane.

**Contents:** Utilization of biotechnical methodologies for the production of biofuels: enzymology and fermentation of of renewables into various fuels.

**Study materials and literature:** To be informed

**Completion:** Examination after the course, two retakes Lectures 14, seminars 14, independent study 100 hours

**Responsible person:** Professor Liisa Viikari

**Other information:** The course will be held in English or Finnish (depending on the attending students)