MEDITERRANEAN AGRONOMIC INSTITUTE OF CHANIA
(MAICh)

POSTGRADUATE ACADEMIC GUIDE

&

ECTS GUIDE

2006 - 2007

Mediterranean Agronomic Institute of Chania (MAICh)
P.O. Box 85, 73100 Chania, Crete, Greece
Tel.: +30 28210 35000 Fax: +30 28210 35001 E-mail: info@maich.gr

This brochure was produced and printed by
MAICh Graphic Arts & Publishing Unit

Contents

Mediterranean Agronomic Institute of Chania (MAICh)

GENERAL DESCRIPTION

By the multilateral Agreement of the governments of Spain, France, Greece, Italy, Portugal, Turkey and Yugoslavia, the International Center of Advanced Mediterranean Agronomic Studies (ICAMAS-CIHEAM) was established* with the purpose of offering post-graduate education – economic and technological, and was ratified by Greece by the legislative decree 4443/64 (Official Journal A 223).

According to the Agreement, CIHEAM can authorize through conventions between itself and the contracting countries the establishment of Institutes or branches which are accredited to offer post graduate education at a Master of Science Level in technological, Applied Biological and Economic sectors related to Agriculture and the Environment. (Act3, par1, section c, Act 6, par.1, and Act 9, par.2 of the founding agreement above).

The establishment in Greece of the Mediterranean Agronomic Institute of Chania (MAICh which is accredited as CIHEAM Institute was ratified by Greece by 1537/85 (Official Journal A 48) and thus obtained the supralegislative validity of Article 28 par. 1 of the Greek Constitution.

MAICh organises international, interdisciplinary post graduate programs and offers scholarships to an average of 150 candidates from 18 different countries annually.

Qualified candidates from CIHEAM or other countries can be eligible for scholarship, fully or partly covering: a) tuition, b) board, c) accommodation, d) pocket money and e) health insurance.

POSTGRADUATE PROGRAMMES AND ACADEMIC AUTHORITIES

MAICH DIRECTOR: Mr. Alkinoos **Nikolaidis**, (alkinoos@maich.gr)

Academic Programmes

- Business Economics and Management, Dr. George **Baourakis** - baouraki@maich.gr
- Environmental Management, Dr. Ioannis **Manakos** - manakos@maich.gr
- Horticultural Genetics and Biotechnology, Dr Panagiotis **Kalaitzis** - panagiot@maich.gr
- Food Quality Management and Chemistry of Natural Products, Dr Panos **Kefalas** - panos@maich.gr
- Natural Products and Biotechnology, Dr Antonios **Makris** - antonios@maich.gr
- Sustainable Agriculture, Dr Ioannis **Livieratos** - livieratos@maich.gr

STUDYING AT MAICh

Three types of postgraduate programme are offered by CIHEAM / MAICh:

1. The Postgraduate Specialisation Programme, Title: DSPU
2. The Master of Science programme, Title: M.Sc.
3. Advanced intensive courses, Certificate of attendance
4. Co-issuing of titles (Joint degree programmes).

* Presently the agreement is ratified by the Governments of Algeria, Egypt, Lebanon, Malta, Morocco, and Tunisia

MAICh at a Glance

	Areas Competence	Academic Support Research Facilities	Cooperation Facilities and Services Laboratory
Business Economics and Management	▪ Management of agribusiness firms ▪ Marketing of organic and food quality products ▪ Financial analysis and applications ▪ Operational management methods ▪ E-commerce practices and services	▪ Computer Laboratories ▪ Spesialised software	▪ Computer Laboratory
Environmental Management	▪ Earth observation and Decision support using GIS/ RS ▪ Spatial planning and environmental impact assessment ▪ Environmental and Agroenvironmental modelling ▪ Agroenvironmental management ▪ Management of Mediterranean Ecosystems	▪ Laboratory of Geographic Information Systems and Remote Sensing ▪ Automated Cartography Unit ▪ Field Survey Unit ▪ Natural Objects Multispectral Identification Unit ▪ Forest Fire Wind Tunnel Simulator Unit	
Horticultural Genetics and Biotechnology	▪ DNA fingerprinting and biodiversity assessment ▪ GMO certification ▪ DNA based agrofood traceability and authentication ▪ Post harvest biotechnology ▪ Plant biotechnology applications	▪ Laboratory of Plant Biotechnology and GMO Testing ▪ Laboratory of Plant Molecular Histology ▪ Laboratory of Horticultural Products Quality	▪ Certification of Genetically Modified Organisms (ISO 17025 under development)
Food Quality Management and Chemistry of Natural Products	▪ Food chemistry ▪ Natural Products: Isolation, Structural education ▪ Antioxidants: Products and methodologies ▪ Food quality management ▪ Product authentication, Chemical fingerprinting	▪ Laboratory of Chemistry of Natural Products and Analytical Chemistry	▪ Analytical Chemistry / ISO 17025 Quality Assurance System
Natural Products & Biotechnology	▪ Natural product characterization and analysis ▪ Enzymology of secondary metabolism ▪ Engineering oxidative stress pathways ▪ Plant molecular biology and biotechnology applications ▪ Plant molecular biology applications	▪ Laboratory of Plant Molecular Biology and Biochemistry ▪ Microbiological Safety Room	
Sustainable Agriculture	▪ Seed germination and certification ▪ Sustainable production methodologies ▪ Soil and tissue analysis ▪ Plant Virology ▪ Greenhouse management	▪ Laboratory of Soil Science and Plant Tissue Analysis ▪ Experimental Recycled Hydroponic Systems for Greenhouses Cultivations ▪ Greenhouses ▪ Laboratory of Seed Germination Testing	▪ Soil Science and Plant Tissue Analysis (ISO 9000 under development)
Medit. Plant Biodiversity Conservation Unit	▪ Seed Bank techniques ▪ Flora of Cretan area ▪ Ex-situ conservation of endemic and threatened plant of Crete ▪ Natura 2000 network in Crete		

Environmental Conservation Facilities	Academic Support Facilities	Cooperation Facilities and Services	Future Developments
	Development and Integrated Support for Information Systems ▪ Administration, support and maintenance of IT hardware and software infra-structure ▪ IT Development and Implementation / Software / data bases / web applications ▪ Collaborative development of IT based postgraduate applications	Conference Centre ▪ Organization and administrative support to Conferences, Seminars, Meetings and Summer Schools	▪ Expansion of the Conference Centre Facilities
		▪ Academic Village: 15 stone houses established in the botanical garden ▪ Student Dormitories: 66 Double, 50 Single and 8 Lofts ▪ Special facilities available for the disabled ▪ Laundry Facilities ▪ Restaurants	▪ Executive trainning Dormitories
	Library and Documentation Centre ▪ On-line information retrieval to several databases national and international ▪ On-line access to the full-text of many Scientific Journals ▪ CD-ROM Server: Access to different databases through the Institute's LAN ▪ Supply of documentation, information and topic-related bibliographical research to collaborating scientists ▪ SDI (Selective Dissemination of Information) upon request ▪ On-line order of books and articles	▪ Recreation and Discussion Facilities ▪ Athletic Facilities	▪ Transformation into an Athletic resource Centre
			▪ Food Biochemistry Laboratory
▪ Seed bank for Local Horticultural Varieties Under Extinction	One Computer Room per graduate programme dedicated to the 2nd year (M.Sc.) students Two dedicated Computer Centres for the 1st year educational needs		▪ Certification of Organic Agricultural Production ▪ Virology Laboratory
▪ Laboratory of Seed Germination Testing ▪ Botanical Garden of Endangered Species ▪ Herbarium of Cretan/ Mediterranean Flora ▪ Seed Bank for Endemic and Endangered Native Species	Printing and Publishing Facility ▪ Graphics design/ layout, off-set printing and / or web applications		

Academic Regulations

I. POSTGRADUATE PROGRAMMES

1. Postgraduate Specialisation Programme

The object of this programme, equivalent to one academic year (9 months) is to help the student acquire knowledge in specific fields of Mediterranean agriculture, business studies, food systems, environment and rural development (Successful completion is a prerequisite for admission to the Master of Science program).

Each specific postgraduate programme includes lectures, conferences, seminars, applied and supervised work.

The CIHEAM Postgraduate Specialisation Diploma is issued upon the successful completion of the postgraduate specialisation programme.

2. Master of Science Programme

The object of this programme, equivalent to two academic years, is to deepen the student's knowledge, critical understanding, and capacity to analyse, evaluate and apply skills in specific areas of Mediterranean agriculture, food systems, environment and rural development.

The first year corresponds to the postgraduate specialisation programme. The second year is dedicated to the elaboration of an original thesis based on research work or on a technical or socio-economic develpment study.

The Master of Science Degree (M.Sc.) is issued by CIHEAM upon the successful completion of this programme.

3. The Advanced Specialised Courses Programme

These courses last less than one academic year. They aim to provide the participants with an advanced knowledge in specific areas of interest for the development of Mediterranean agriculture and related sciences.

They may also consist of one or more sequences of one of the postgraduate specialisation programmes.

A Certificate of Attendance is awarded upon the successful completion of Specialised Courses.

A Specialised Studies Certificate is awarded upon the successful completion of courses lasting more than three months.

4. Co-issuing of titles (Joint degree programmes)

CIHEAM may jointly offer the above titles with one or more higher education and research institutions. These titles would be issued by the cooperating institutions and the joint programmes should be in full accordance of the present academic regulations.

II. CONDITIONS FOR ADMISSION TO THE POSTGRADUATE PROGRAMMES

1. Admission to the Postgraduate Specialization and the Master of Science Programmes

a) Applicants must have the academic level that qualifies them to undertake postgraduate level studies in their home country equivalent to a minimum of four years undergraduate studies. Their degree must also be in a discipline compatible with the area of specialisation requested. Additional conditions may be required for certain programmes.

b) The working language of MAICh is English. Upon provisional acceptance, candidates are obliged to take the TOEFL (Test of English as a Foreign Language) and the TWE (Test of Written English). The provisional acceptance status is suspended for candidates who fail to attain a 500 point score. The provisional acceptance status is upgraded to a probational status for students who attain a TOEFL score between 420 and 550 score.

   A minimum TOEFL score of 500 TOEFL is needed for the awarding of the Postgraduate Specialisation diploma.

   A TOEFL score over 550 and a TWE pass are necessary precondition for acceptance to the Master of Science programme.

c) Selection is made on the basis of the dossiers submitted by applicants, priority being given to applicants from CIHEAM member countries, and takes account of their academic results and professional experience acquired in the chosen field of specialisation.

d) For each postgraduate specialisation programme, the final decision on the admission of applicants is made by the CIHEAM Governing Board, following the recommendations of the director of the MAI where the programme is offered.

   In this respect, the Governing Board can nevertheless delegate upon the MAI director. The director keeps the Board informed on the final admission decisions taken concerning the MAI.

2. Admission to the Advanced Specialised Courses Programme

Decisions on admissions are made on the basis of the dossier submitted by the applicants. Educational and professional experiences are taken into account. The conditions stated in II.1 a), b) and c) above must be fulfilled.

The decisions on admissions are taken by the director of the MAI where the course is offered.

III. ORGANISATION OF THE POSTGRADUATE PROGRAMMES

1. Educational Activities

a) The different CIHEAM academic programmes provide for a range of educational activities: lectures, seminars, conferences, supervised and applied work.

b) Instruction is given by permanent, associate or visiting lecturers. The programmes and list of lecturers are approved by the Governing Board on the basis of proposals submitted by an ad hoc group made up of experts in the area concerned.

   In this respect, the Governing Board can nevertheless delegate upon the MAI director. The director keeps the Board informed on the programmes and the list of lecturers elaborated by the MAI.

c) Students must attend all lectures, seminars, conferences, applied and supervised work. A full time presence is required. Lack of punctuality in a programmed activity is considered as an

absence. The Institute is the final judge of what constitutes a valid reason to justify the absence. The MAI reserve the right to penalise for incomplete attendance.

The final grade(s) may be reduced by individual lecturers when attendance does not meet a predetermined number of sessions.

d) The students' progress is monitored throughout their educational programmes.

2. Credit System

Postgraduate programmes are organised in cycles, made up of different units for which a certain number of credits are given. CIHEAM implements a credit system analogous to the European Credit Transfer System (ECTS). Each unit is assigned a number of credits reflecting the total effort (lectures, seminars, assessment procedures, applied and supervised work) required to pass it successfully, which is proportionate to the total effort needed to complete a full year of academic study. An academic year, comprising 20 to 30 weeks full-time study, represents 60 credits. Therefore, a full week's work represents approximately two to three credits.

Credits may also be awarded for short courses as a way of developing lifelong learning or continuous professional schemes and thus facilitating the recognition of these credits and learning in different countries and institutions.

A credit cannot be awarded for attendance alone. Student's assessment is always required.

a) **Formal instruction.**

A standard week for a regular course is comprised of 15 to 20 hours of lectures and up to 30 to 45 hours of personal work, seminars and conferences, applied work, tutorials, lab and field work, etc.. Two to three credits, depending on the subjects and the total length of the academic year, may be assigned to a standard week.

b) **Supervised work.**

A credit may also be awarded for approximately 20-25 hours of supervised independent or group work if the results have been assessed and graded.

c) **Evaluation of Courses.**

Usually examinations are held when all courses of one module are completed.

Oral Examination. In addition to the written examinations, a comprehensive oral examination conducted by an Examination Board will be held at the end of the academic year. The relative weight to the total grade is 15%. There in no retake of the oral examination.

Scientific English Examination. Students are obliged to attend a 45-hour course in Scientific English upon the completion of which students are given a grade out of 100. This grade corresponds to 3 ECTS credits.

Retake Policies and Incomplete Courses. To improve grades or to be graded for incomplete courses students have the option of retaking course examinations of their preference equivalent of 9 ECTS credits during a weeklong retake period.

There is no retake examination period for the last module.

The Institute is the final judge of what constitutes an incomplete course.

3. Grading System

Grading measures the student's level of achievement, both in absolute terms and compared with peer-performance. It is based on the student's participation in all training activities organised as part of the course.

The grading, numerical scores and the approximated expected ranking structure of students passing in each academic unit are depicted in the table below.

Grade	Numerical Score	Approximate expected ranking (%)	Definition
A	85 - 100	15	EXCELLENT. Outstanding performance with only minor deficiencies
B	70 - 84	35	GOOD. Above the average standard but with some deficiencies
C	50 - 69	35	SATISFACTORY. Performance meets the minimum criteria and is fair but with shortcomings
D	40 - 49	15	UNSATISFACTORY. Some more work is required before the credit can be directly awarded. The credit may be compensated by other sections of the overall course program. Students may retake the test
F	0 - 39		FAIL. Considerable further work is required. No credit awarded

The translation of ranks to grades may be altered depending on, for example, a limited number of students in a course or the specific academic performance of a given class compared with others in previous years.

IV. CONDITIONS FOR AWARDING THE POSTGRADUATE SPECIALISATION DIPLOMA

The postgraduate specialisation diploma is issued upon the successful completion of a CIHEAM specialisation programme.

1. At the beginning of each postgraduate specialisation programme, the lecturers of the corresponding MAI establish a training schedule, approved by the director, determining the instruction to be given and the kind of personal work that each student might have to do.

   Some of the course work included in the syllabus may be followed in another MAI or at an external institution outside of CIHEAM premises.

2. To obtain the postgraduate specialization diploma the student must:
   - satisfy all the requirements of the syllabus,
   - obtain a minimum of 60 credits for the whole programme, including 40 formal instruction credits from the MAI to which the student was admitted,
   - obtain an overall grade equal to or above C (average numerical score equal or above 50) and no unit graded below D,
   - for students with five years of proven professional experience, the number of formal instruction credits they require to obtain the postgraduate specialisation diploma may be reduced by decision of the MAI director following assessment.

3. The postgraduate specialisation diploma with distinction is issued under the following conditions:

   Cum Laude distinction
   Overall grade equals to B
   (average numerical score between 70 and 84)

   Cum Maxima Laude distinction
   Overall grade equals to A
   (average numerical score equal or above 85)

4. The postgraduate diploma is granted by the MAI at which the student followed the corresponding specialisation programme. It provides the following indications:

   - name of the postgraduate specialisation programme,
   - the distinction obtained if applicable.

   The diploma is signed by the CIHEAM Secretary General and by the director of the Institute at which the trainees followed the programme.

   A standard study file issued with the diploma gives a detailed description of the instruction followed, the names and qualifications of lecturers, the nature of the work carried out and the results obtained (numerical grade scores on a scale from 0 to 100)

5. Upon completion of the first academic year, students with a non-passing grade will receive a certificate of attendance.

   Students with incomplete courses may be allowed to participate in the following year's principal modules examination period(s). Upon successful completion, such students will be able to obtain the Post-Graduate Diploma. Students will have to undertake all traveling, boarding and lodging expenditures.

6. Improper academic and personal conduct could result in suspension of the scholarship or expulsion from the Institute, irrespective of the academic performance. In the case of expulsion, a justified written decision has to be taken by the concerned MAI Director and confirmed by the Secretary General.

V. CONDITION FOR AWARDING THE MASTER OF SCIENCE DEGREE

The Master of Science degree (MSc) is issued upon the successful completion of a Master of Science programme. It represents the acquisition of a total of 120 credits.

1. Requirements for Admission to the Master's Programme

a) At the end of the postgraduate specialisation programme, the student is required to have obtained an overall grade equaling or exceeding B (average numerical score equal to or above 70).

b) The student must submit a proposal for an experimental research project or a technical and/or socio-economic development study, which must be accepted by the director(s) of the MAI.

c) The student must obtain the approval of a professor, researcher or any other person qualified to supervise the required work.

d) According to available resources, each MAI may set a limit to the number of students admitted to the second year of the M. Sc. Program.

e) The final decision regarding admissions to the second year is made by each MAI director.

A TOEFL score exceeding 550 and a TWE pass are a necessary precondition for acceptance to the Master of Science programme.

Under extraordinary circumstances such as a Grade Point Average bordering on B, a M.Sc. candidate may be requested to participate in the retake examination period in the following academic year. In the above circumstances the M.Sc. candidate should also submit a written M.Sc. proposal accepted by a University Professor in his/her own country. The student is obliged to take on his own expenses during that period.

2. Requirement for the Master of Science Programme

a) The Master of Science programme consists of:

- a CIHEAM postgraduate specialisation programme (60 credits)
- a second year whereby the student undertakes research within the same or a different MAI (60 credits)

b) The length of the second year should not exceed one academic year. It may however be extended with the approval of the MAI director.

c) The period of time between the enrolment date in a postgraduate specialisation programme and the date of obtaining the Master of Science degree cannot exceed four years, unless an exceptional derogation is given by the Secretary General on the proposal of the MAI director.

3. Conditions Governing the Award of Master of Science Degree

a) The student must have:

- satisfied all the requirements of the second year syllabus,
- obtained 60 credits during the second year, of which a minimum of 40 are for supervised work,
- submitted an original thesis based on research work or on a technical or socio-economic development study,
- obtained an overall grade equaling or exceeding C (average numerical score equal or above 50) and no unit graded below D.

b) The M.Sc. thesis committee must include lecturers of the institute and outside authorities, of different nationalities whenever possible. The chairman of the committee must be a university professor, director of research or equivalent.

c) Individual public examination before a M.Sc. thesis committee is the preferred method of assessing the M.Sc. thesis. However, optimum allocation of resources may justify alternative approaches. A single local committee might be established for the examination of M.Sc. theses submitted during any given period of time. This committee could put questions raised by external reviewers to candidates and evaluate the students' responses. Other alternatives may consist of using new information technologies, such as video-conferencing or free private Internet and open discussion between the candidate and the committee members.

d) All the second year work assignments are evaluated. Distinctions for the Master of Science degree are awarded as follows:

Cum Laude distinction
Overall grade equaling B
(average numerical score between 70 and 84)

Cum Maxima Laude distinction
Overall grade equaling A
(average numerical score equal or above 85)

e) The Master of Science degree is awarded by the CIHEAM through the MAI at which the student pursued the first year of studies. It gives the following indications:

- name of the Master of Science programme,
- the distinction obtained if applicable.

f) The Master of Science degree is signed by the Chairman of the Governing Board and by the CIHEAM Secretary General.

A standard study file issued with the degree gives a detailed description of the instruction followed during the second year, the names and qualifications of lecturers, the nature of the supervised work, the names of the members of the committee and the results obtained (numerical scores on a scale from 0 to 100 and grades).

VI. SPECIAL PROVISIONS PERTAINING TO THE ADVANCED SPECIALISED COURSES PROGRAMME

1. Regarding courses organised through the initiative of CIHEAM or established at the request of organizations or governments, the participants must satisfy specific requirements to obtain the course certificate.

2. In the case of advanced specialised courses corresponding to one of the modules of a postgraduate specialisation programme, the participants are authorised to take the corresponding examinations.

3. With the aim of promoting lifelong learning, participants are authorised to request obtaining some or all of the credits required for the completion of the first year from a number of short specialised courses taken over consecutive years.

   Each request is submitted to an academic committee who will decide on its acceptance. If approval is granted, a program followed over several years will have to comply with the academic standards set by the committee.

   Candidates who have satisfied the requirements laid down in the present regulations may apply for the postgraduate specialisation diploma once the approval of the Secretary General has been obtained. In such circumstances, they may be admitted into the second year of the Master of Science programme. The period of time between the date of enrolment on a specialised course and the date when the Master of Science degree is obtained may exceed the four years stipulated in section V.1.c.

VII. FINAL PROVISIONS

1. According to the specific character of each educational activity, special provisions may be included in the regulations on applications established by each MAI and approved by the Governing Board, provided that they are not in contradiction with the general provisions above.

2. The Governing Board will proceed to a re-examination of the present regulations at the end of a three year period starting from its adoption.

APPLICATION PROCESS

Application to Degree Programmes

To apply for admission to a graduate degree program, individuals must send a completed application form for admission to the Programme. Application forms may be downloaded from the website address: **http://www.maich.gr/admissions/**, or requested by email, **admissions@maich.gr**.

The documents which are required to be submitted for an application in order to be considered complete are:

a) **Certified copy of the University Degree translated into English** (minimum of 4 years the bachelor's degree or 240 ECTS credits for European Charter Institutions).

b) **Certified copy of your University Transcripts translated into English**.

The certified transcript copies must be sent directly to the admissions office. In the case of an institution that does not issue transcripts other than the single official copy presented to the student, a certified photocopy may be submitted with the application form provided that the applicant Verification of authenticity by the Admissions Office upon arrival at MAICh may be requested.

c) **Official transcript showing completion of any master's or higher degrees**.

Official transcripts for any other graduate work completed, may be submitted, if the work is to be considered for the student's candidacy to the degree programme. If official transcripts for previously completed graduate work are not provided at the time of application to the programme, credit for that work cannot be considered at a later date.

d) **Three (3) recommendation letters**.

Three former academic supervisors should provide a letter of recommendation to the Admissions Office attesting to the student's ability to pursue postgraduate studies.

e) **A proven competence of the English language**.

Competence in the English language applied in the educational activities is required if English is not the native language.

f) **Medical certificate**,

g) **Two (2) photos**.

Remarks

- Application for admission will be considered if the applicant is in his/her last term of undergraduate study; however, official admission will be conditional upon the applicant's graduation and fulfilment of all the admission requirements.
- After application credentials have been evaluated, students will be notified of their admission status. Selection is made on the basis of the files submitted by applicants (priority being given to applicants from the International Center for Advanced Mediterranean Agronomic Studies (CIHEAM) member countries) and takes into account academic results, letters of recommendation and professional experience acquired in the chosen field of specialisation.
- It should be noted that the average student pursuing postgraduate studies at MAICh is in the beginning of his/her career and seeks to enhance his/her qualifications in order to acquire a better position in the academic community and/or the professional job market.

Therefore, students proceeding to obtain a Master's program at MAICH are generally recent graduates.

All application documents become the property of the Institute and are not returned to applicants or forwarded to other institutions.

Applications deadline: 30 July 2005

All relevant information should be mailed by post to the following address:

Mediterranean Agronomic Institute of Chania
Alsyllio Agrokepion, P.O. Box 85,
Chania 73100,
Crete, Greece
Tel.: +30–28210–35000

Registration

Graduate applicants who have been admitted to a degree programme at MAICH will be sent a student data form, a statement of acceptance to register and a time schedule of graduate classes. The reply to the statement of registration acceptance should be send immediately.

Reactivation

Applicants, who do not enrol in postgraduate course work at MAICH from the beginning of the calendar year they were admitted for, are considered inactive. Inactive applicants as well as conditional admitted applicants must update and reactivate their files by completing a reactivation form before they are eligible to register for the postgraduate courses. Forms are available at, and must be submitted to, the Admissions office.

Exchange Programmes at MAICh

SOCRATES / ERASMUS PROGRAMME

ERASMUS is the higher education Action of SOCRATES II programme. It seeks to enhance the quality and reinforce the European dimension of higher education by encouraging transnational cooperation between universities, boosting European mobility and improving the transparency and full academic recognition of studies and qualifications throughout the Union.

Erasmus gives students the opportunity to study for a period of 3-12 months at a university or higher education establishment in another participating country. As a matter of principle, the time spent in the host country must be fully recognised by the home institution. The European credit transfer system (ECTS) is the major instrument to facilitate academic recognition of periods of study in partner establishments. It should be clear that there must be prior agreement between the universities concerned before a person can benefit from the Erasmus scheme.

To support their mobility — a period of study in the host country — students may be entitled to an Erasmus grant in addition to the grants which they normally receive from other sources such as their region, state, or university. This European grant is intended to help to cover the cost of travelling and the difference in cost of living.

MAICh SOCRATES / ERASMUS EXCHANGES STRUCTURE

ECTS INSTITUTIONAL COORDINATOR: Mr. Alkinoos **Nikolaidis** - director, (alkinoos@maich.gr)

ERASMUS COORDINATOR: Dr Antonios **Makris**, (antonios@maich.gr)

SCIENTIFIC COORDINATORS

BUSINESS ECONOMICS AND MANAGEMENT: Dr. George **Baourakis**, (baouraki@maich.gr)

ENVIRONMENTAL MANAGEMENT: Dr. Ioannis **Manakos** (manakos@maich.gr)

HORTICULTURAL GENETICS AND BIOTECHNOLOGY: Dr Panagiotis **Kalaitzis**, panagiot@maich.gr

FOOD QUALITY MANAGEMENT AND CHEMISTRY OF NATURAL PRODUCTS: Dr Panos **Kefalas** (panos@maich.gr)

NATURAL PRODUCTS AND BIOTECHNOLOGY: Dr Antonios **Makris**, (antonios@maich.gr)

SUSTAINABLE AGRICULTURE: Dr Ioannis **Livieratos**, (livieratos@maich.gr)

APPLICATION OF ECTS CREDIT SYSTEM AT MAICh

Application Procedures: Eligibility Requirements, Deadlines and Limitations

1. Eligibility

a. Establishment of a Bilateral Institutional ERASMUS/ECTS agreement between home and host institution, which is a bilateral agreement that formalises the student and teaching mobility in related fields.

b. Establishment of Learning Agreement between home/host and student, which regulates the course unit programme to be attended, the number of ECTS credits and the approval of the host and home institution.

2. Requirements

Students at postgraduate level: Four-year graduation degree from any institution and acceptance for a postgraduate degree at home institution. Submission of the degree and academic transcript officially translated into English.

Students in their final undergraduate year at home institution. Submission of academic transcripts officially translated into English. Max mobility period, six months.

Competence in the English language: Given that courses are held in English at MAICh, it is strongly advised that the home ECTS Erasmus Coordinator take into particular consideration the English language skills of the candidate exchange student.

3. Erasmus Student Study Programme

Three study options are available for ERASMUS Exchange Students:

i. Attendance of the academic coursework programme which runs from October to June.

ii. Project work under the supervision of research scientists at the Institute provided that they submit a well documented proposal and that research scientists at MAICh are available to undertake the proposed guided independent study.

iii. Continuous Professional Development.

Upon award of the ECTS label and the approval of a lifelong learning grant, the Institute would increase access for Continuous Professional Development.

4. Deadlines

Applicants for SOCRATES/ERASMUS exchange programmes are required to fill in the annexed documents **Application Form**, **Transcript of Records** and **Learning Agreement**. The responsible SOCRATES/ERASMUS Office of the Home Institution should send the 3 documents by Mail to the Institutional Erasmus Coordinator at least two months prior to students' arrival, duly signed by the Departmental Coordinator of the Home Institution. Students who arrive at the Mediterranean Agronomic Institute of Chania without having previously sent the abovementioned documents duly signed will not be accepted.

5. Capacity Limitations regarding Erasmus incoming students to MAICh

MAICh is able to accept a maximum of 25 Erasmus students during the academic year (October-June) due to postgraduate class size limitations.

This poses some limitations on the number of Erasmus students accepted per institutional agreement.

Student Workload

MAICh offers postgraduate programmes which consist of 24-25 consecutive weekly course units. The programme is organised in sections made up of the required course units. The postgraduate programmes indicating course titles and weekly-time schedules are annexed to the present document.

1. Formal Instruction Credits

a. Each weekly course unit comprises 20 hours of a combination of the following types of courses: lectures, seminars, research seminars, exercise courses, practical and laboratory work, depending on learning aims and competences to be achieved.

b. An additional 55 hours per week course unit of personal student workload.

2. Guided Personal Study Credits

One credit is awarded for approximately 20-25 hours of supervised independent work, provided that the results are assessed and graded accordingly.

ECTS Assessment and Grading Scale

Grading measures the student's level of achievement, both in absolute terms and compared with peer-performance. It is based on the student's participation in all training activities organised as part of the course.

The grading, numerical scores and the approximated expected ranking structure of students passing in each academic unit are depicted in the table below.

Grade	Numerical Score	Approximate expected ranking (%)	Definition
A	85 - 100	15	EXCELLENT. Outstanding performance with only minor deficiencies
B	70 - 84	35	GOOD. Above the average standard but with some deficiencies
C	50 - 69	35	SATISFACTORY. Performance meets the minimum criteria and is fair but with shortcomings
D	40 - 49	15	UNSATISFACTORY. Some more work is required before the credit can be directly awarded. The credit may be compensated by other sections of the overall course program. Students may retake the test
F	0 - 39		FAIL. Considerable further work is required. No credit awarded

IMPORTANT FEATURES EXTRACTED FROM THE USERS' GUIDE OF THE EUROPEAN CREDIT TRANSFER AND ACCUMULATION SYSTEM (ECTS)

Key Features of ECTS

- ECTS is based on the principle that 60 credits measure the workload of a full-time student during one academic year. The 60 ECTS credits amount to around 1500-1800 hours of workload per academic year, thus one credit corresponds to around 25 to 30 working hours.
- Recognition of ECTS credits are obligatory in the case of agreed student mobility when there is a prior Learning Agreement. The ECTS Transcripts of Records and the Diploma Supplement facilitate recognition of ECTS transfer.
- ECTS credits are awarded upon successful completion of the work required and appropriate assessment of the learning outcomes achieved.
- Only the courses listed in the Learning Agreement between host/home institutions and the students are recognised for the ECTS transfer.

ADMINISTRATIVE PROCEDURES AND COSTS

VISA requirements for non-EU students

a. For study programmes which run for three months, only a visa is required.

b. For study programmes which run for over three months, the following must be undertaken:

   i. Application for a student visa.

   ii. Payment of the amount of 200 EURO upon arrival at MAICh to the Greek authorities responsible for issuing the residence permit.

   ii. Issue of a certificate (written in Greek if possible, otherwise English) from student's native country verifying that he/she has full medical insurance to cover his/her stay in Greece (doctor, medication, hospital treatment) or the option of taking out the medical insurance policy available at MAICh at a charge of 13 EURO per month.

   For reasons of convenience, it is strongly advised that students choose the second option.

Tuition Fees, Board and Accommodation

Tuition Fees: Exchange Students within the European SOCRATES/ERASMUS programme or exchange students coming to MAICh under the bilateral agreements are not charged tuition fees.

Board and Accommodation: Full board and accommodation at MAICh are offered to SOCRATES/ERASMUS students at the following rates:

- Private room 250 Euro per month
- Shared room 150 Euro per month.

Business Economics and Management

Postgraduate Specialisation and M.Sc. Programme

SCIENTIFIC COORDINATOR: **Dr. George Baourakis**

EDUCATIONAL AND PROFESSIONAL GOALS

The Master's program in Business Economics and Management provides a two-year curriculm for graduates holding a university Bachelors degree in Economics, Business, Agriculture, Engineering and Social or other related sciences.

In the first year participants pursue the Postgraduate Specialization Certificate. The objectives of this course of study are to: i) support management through merging the necessary knowledge of economic theory regarding resource allocation and evaluation in their social context; ii) facilitate decision making through the application of modern operational management methodologies and techniques to achieve efficiency; iii) provide advanced knowledge on the application of econometric theory to business market situations within the framework of the Common Agricultural Policy; iv) specify the requirements of business strategic management, i.e. business requirements relative to financial and marketing strategies and the tools of market research. The first year students receive a solid theoretical and practical training in the following areas: management, marketing, e-commerce, regional management, financial management and business economics. Field and computer laboratory exercises combined with these courses provide a more practical and tangible perspective. The qualified first year graduates are entitled to carry out their research in an environment fully equipped with the most updated facilities.

In the second year, students who have successfully completed the first year and who have met all the pre-requisites set by the Institute, develop a thesis based on research work and economic development leading to a Master's of Science degree.

The scientific results derived from the graduate studies are usually announced in International Conferences and/or published in World Renowned Journals.

ACCESS TO FURTHER STUDIES

Statistics show that 28% of M.Sc. graduate students are accepted in Ph.D. programmes with full scholarship in European and North American Universities.

POST GRADUATE SPECIALISATION PROGRAMME

The programme is organized in 7 sections

Section I - Introductory (english, computers)

Knowledge updating in the English language, introductory computing.

Section II - Advanced Statistics

This section is comprised of courses related to basic concepts of statistics and computer applications using SPSS or SAS statistical software packages in order to strengthen the background of the students in statistics.

Section III - Economics of Resource Allocation

It covers the basic principles of economics, mathematics, production theory and functions, supply and demand elasticities, resource and welfare economics.

Section IV - Investment Decisions

It focuses on cost benefit analysis, financial, economic and environmental appraisal of investment projects, and impact assessment.

Section V - Operational Management Methods

It is dedicated to the principles of management, operations research/management science methodologies and advanced optimization techniques.

Section VI - Business Economics

The Business Economics provides an overview of the market models such as perfect competition, monopoly, oligopoly and the behaviour of food product prices. This module also covers macroeconomic concepts, econometrics and time series analysis, as well as market performance and public policy in the food industries, and financial management. Finally, a course on Common Agricultural Policy provides knowledge on historical, institutional and comparative aspects of the European Community and European agriculture.

Section VII - Management - Marketing

It includes courses on strategic management and the management of business firms. The second part is dedicated to marketing strategies, advertising, promotion, product differentiation and marketing regulations. Finally, one week will be devoted to market research which will provide students with tools and applications of marketing research techniques such as questionnaire design, data collection and data analysis.

TRAINING SEQUENCE

Section I - Introductory (english, computers) [4 ECTS]
October

BEM.501 - Scientific English (3 ECTS)

BEM.502 - Introduction to Computers (1 ECTS)

Section II - Advanced Statistics [6 ECTS]
from October to November

BEM.510 - Database and Data Mining (3 ECTS)

BEM.511 - Parametric and Non-Parametric Statistics (3 ECTS)

Section III - Economics of Resource Allocation [9 ECTS]
from November to December

BEM.520 - Mathematics for Decision Making (3 ECTS)

BEM.521 - Supply and Demand Theory – Market Models (3 ECTS)

BEM.522 - Resource and Welfare Economics (3 ECTS)

Section IV - Investment Decisions [6 ECTS]
January

BEM.530 - Theory and Applications of Cost-Benefit Analysis (3 ECTS)

BEM.531 - Project Appraisal (3 ECTS)

Section V - Operational Management Methods [6 ECTS]
February

BEM.540 - Principles of Management (3 ECTS)

BEM.541 - Operations Research (3 ECTS)

Section VI - Business Economics [21 ECTS]
from March to April

BEM.550 - Market Structure – Price Analysis (6 ECTS)

BEM.551 - Macroeconomics (3 ECTS)

BEM.552 - Econometrics and Time Series Analysis (3 ECTS)

BEM.553 - Food Economics (3 ECTS)

BEM.554 - Agricultural Marketing and Policy (3 ECTS)

BEM.555 - Financial Management (3 ECTS)

Section VII - Management - Marketing [12 ECTS]
from May to June

BEM.560 - Management of Business Cooperatives (3 ECTS)

BEM.561 - Strategic Management (3 ECTS)

BEM.562 - Marketing (3 ECTS)

BEM.563 - Market Research (3 ECTS)

COMPREHENSIVE ORAL OR WRITTEN EXAMINATION (MODALITIES AND DATES)

During Section I, participants attend classes on English TOEFL and Introduction to Computers. They are also obliged to attend a 45-hour course in Scientific English which is equally distributed during Sections I – V, and then take a written examination.

Participants take three written examinations during Section II and Section III respectively, equally distributed over time, each unit being independently graded.

Participants take three written examinations during Section IV, and present 2 written assignments in groups for the evaluation of units 2 and 3, each unit being independently graded.

Participants take two written examinations for Section V and present a written individual exercise for the evaluation of unit 3. Each unit is independently graded.

To evaluate Section VI participants sit in on five written examinations and present a written personal assignment for the evaluation of unit 4. Each unit is independently graded.

Participants take one written examination during Section VII and present three written assignments in groups for the evaluation of units 1, 3 and 4. Each unit is independently graded.

A comprehensive oral examination conducted by an Examination Board takes place at the end of the academic year, representing 15% of the total grade.

Written exams consist of a set of questions that require a concise answer. Some of the questions are multiple choice. Lengthy questions are avoided.

Participants may retake their exams if they have failed in any one of sections II, III, IV and V.

ANALYTICAL SYLLABUS

BEM.501 - **Scientific English** (3 ECTS)

LECTURER: Mrs. Irene Maravelaki

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Development of academic writing skills, study of scientific texts and papers.

PREREQUISITES: Fluency of English language (TOEFL level)

COURSE CONTENTS

Study of scientific texts. Terminology and grammar. Development of academic writing, public speaking and communication skills.

RECOMMENDED READING

Vince M., First Certificate Language Practice, Read Educational & Professional Publishing Ltd., Halley Court, Jordan Hill, 1996.

Economics, Cassell Publishers Ltd., Villiers House, London, 1989.

Marketing, Maggie Jo St. John, Prentice Hall, 1992.

Thomson A. Jr. & Strickland A., Strategic Management, Concepts and Cases, McGraw-Hill Irvin, Thirteen Edition, 2003.

ASSESSMENT METHODS: Written exam, Oral exam, Cluster presentation

BEM.502 - **Introduction to Computers** (1 ECTS)

LECTURER: Dr. George Baourakis

TYPE OF COURSE AND TEACHING METHODS: Computer-assisted teaching

OBJECTIVE OF THE COURSE: Experience with computer networks, communication protocols, and database management.

PREREQUISITES: Basic knowledge of computer hardware and software

COURSE CONTENTS

Computer hardware components, peripherals and controllers, architecture, operating systems. Interaction with computers. Data communications and computer networks. The Internet: brief history, protocols, addressing and domain name service (DNS). E-mail, News-Groups, Telnet, Ftp, WWW (World Wide Web). Computer applications: word processing, spread-sheets, data-bases, graphics, scientific software, schedulers. Computer Security.

RECOMMENDED READING

Training material in accordance with ECDL (European Computing Driving Licence)

ASSESSMENT METHODS: Computer-Assisted Exam

BEM.510 - **Database and Data Mining** (3 ECTS)

LECTURER: Prof. Panos Pardalos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Databases - types, knowledge and programming.

PREREQUISITES: Good knowledge of Statistics is required.

COURSE CONTENTS

Type of data, information, scale of measurements, records and files, electronic data sheets, hierarchical databases, relational databases object oriented databases, knowledge databases, programming with MSAccess database, quizzes, homeworks, find project, examination.

RECOMMENDED READING

From Data Mining to Knowledge Discovery in Databases, Usama Fayyad, Gregory Piatetsky-Shapiro, and Padhraic Smyth, AI Magazine 17(3): Fall 1996, 37-54, http://www.kdnuggets.com/gpspubs/aimag-kdd-overview-1996-Fayyad.pdf

A Survey of Data Mining software Tools by Michael Goebel and Le Gruenwald, http://www.acm.org/sigs/sigkdd/explorations/issue1-1/hand.pdf

Survey of Clustering Data Mining Techniques, https://umdrive.memphis.edu/vphan/public/berkhin-survey.pdf

Survey of Microarray Data Mining, http://www.nr.no/files/samba/smbi/microarraysurvey.pdf

Survey of Evolutionary Algorithms for Data mining, http://citeseer.ist.psu.edu/cache/papers/cs/23050/http:zSzzSzwww.ppgia.pucpr.brzSz~alexzSzpub, papers.dirzSzAdvEC-bk.pdf/freitas01survey.pdf

Data Mining: An Overview from Database Perspective, http://ir.iit.edu/~dagr/cs522/files/handouts/ExcellentSurvey.pdf

From Data Mining to Knowledge Discovery in Databases, http://www.kdnuggets.com/gpspubs/aimag-kdd-overview-1996-Fayyad.pdf

Knowledge discovery from soil maps using inductive learning, http://www.ucgis.org/summer03/studentpapers/fengqi.pdf

Data mining applications in agriculture, http://www.cs.waikato.ac.nz/~ml/publications/1999/99SJC-GH-Innovative-apps.pdf

A Knowledge-based Geo-Spatial Decision Support System for Drought Assesment, http://dgrc.org/dgo2004/disc/demos/mondemos/kozal.pdf

ASSESSMENT METHODS: Project Presentation

BEM.511 - **Parametric and Non-Parametric Statistics** (3 ECTS)

LECTURER: Prof Andronikos Mauromoustakos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Basic concepts of statistics along with statistical software packages.

PREREQUISITES: Good knowledge of Statistics is required

COURSE CONTENTS

Distributions (Binomial, Poison, Normal, x2, t and F) Populations and samples, Estimation of the mean and of the variance, Confidence interval estimation, Comparison of the means (t–test, one and two–way ANOVA), Linear Regression and Correlations, Multiple Regression, x2 tests of independence (Contingency tables).

RECOMMENDED READING

Foster D.F., Stine R.A. and Waterman R.P., Basic Business Statistics, Springer, New York, 1998

ASSESSMENT METHODS: Computer-Assisted Exam

BEM.520 - **Mathematics for Decision Making** (3 ECTS)

LECTURER: Prof Emmanuel Petrakis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Fundamental concepts and models of Mathematical Economics.

PREREQUISITES: Knowledge on Mathematics is required

COURSE CONTENTS

Economic models, Elements of set theory, Functions, The Euclidean space. Linear algebra: Vectors - Operations, Linear Dependence, Bases; Matrices - Definitions and fundamental concepts, Algebra of matrices, Transposition, Trace, Determinants, Rank, Inversion, Solution of linear systems, Eigenvalues, Quadratic forms. Univariate calculus: The concept of derivative, Rules of differentiation, Second derivative and curvature, Integrals, Economic applications. Multivariate calculus: Partial derivatives, Total differentials, Chain rule, Higher order derivatives-Hessians, Implicit functions, Level curves, Homogeneous functions, Concave-convex functions, Economic applications. Static optimisation: Unconstrained optimisation, Optimisation with equality constraints, Optimisation with inequality constraints - nonlinear programming, linear programming, comparative statics, economic applications. Elements of ordinary differential equations: Definitions, First-order differential equations, Systems of first-order differential equations. Dynamic optimization: basic concepts, Hamiltonian and the maximum principle, Infinite horizon problems.

RECOMMENDED READING

Chiang A., Fundamental Methods of Mathematical Economics, MacGraw Hill, 3rd Ed, 1990, Chapters 1, 4, 5, 6, 7, 11, 12

Glaister S., Mathematical Methods for Economists, Balckwell, 1984, Chapters 1-10

Lambert P., Advanced Mathematics for Economists, Blackwell, 1985, Chapters 1,3

Sydsaeter K. and Hammond P., Mathematics for Economic Analysis, Prentice Hall, 1995, Chapters 16, 17, 18

ASSESSMENT METHODS: Written exam

BEM.521 - **Supply and Demand Theory – Market Models** (3 ECTS)

LECTURER: Prof. Kostas Karantininis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Specialisation in consumer theory and market models.

PREREQUISITES: Students must have completed the course on "Mathematics for Decision Making"

COURSE CONTENTS

Production Theory. Production and Cost functions. Long-run theory of the firm. Dynamic theory of the firm. Consumption set. The budget set. Preference relations: basic properties. Preference and utility. The utility maximisation problem. The expenditure minimisation problem. Demand, indirect utility and expenditure function: properties and duality. Supply and demand elasticities and applications.

RECOMMENDED READING

Varian H.R., Intermediate Microeconomics: instructor's manual and test item file, 2nd ed., New York, W.W. Norton, 1990

Gravelle H. and Rees R., Microeconomics, London, Longman, 1981

Koutsoyiannis A., Modern Microeconomics, 2nd ed., Hong Kong, MacMillan, 1979

Blair R.D., Microeconomics for managerial decision making, Auckland, McGraw Hill, 1982

ASSESSMENT METHODS: Written exam

BEM.522 - **Resource and Welfare Economics** (3 ECTS)

LECTURER: Prof. Spiro Stefanou

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Knowledge development on production economics

PREREQUISITES: Students must have completed the course on "Mathematics for Decision Making"

COURSE CONTENTS

Optimum resource allocation in single and multi-product firms, derived input demand and product supply functions. Pareto Optimality: The Pareto criterion, Exchange efficiency, Production efficiency. The Compensation principle: Compensation principle, Potential welfare criterion, Social welfare function. The Concept of Surplus: Producer surplus, Consumer surplus, Uniqueness and path dependence of consumer surplus, Social surplus.

RECOMMENDED READING

Just, R.E., D.L. Hueth and A. Schmitz, Applied Welfare Economics and Public Policy, Prentice Hall, 1982.
Silberberg, E., The Structure of Economics: A Mathematical Analysis, McGraw-Hill (more advanced), 1990.
Gravelle, H. and R.Rees, Microeconomics, Longman, 1981.

ASSESSMENT METHODS: Written exam

BEM.530 - **Theory and Applications of Cost-Benefit Analysis** (3 ECTS)

LECTURER: Prof. Anastasios Xepapadeas

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Concepts on cost-benefit analysis.

PREREQUISITES: Students must have completed the course on "Resource and Welfare Economics"

COURSE CONTENTS

Capital Budgeting: Estimating cash flow, NPV, IRR, Payback period, The effects of inflation and uncertainty, NPV vs. IRR, The choice of the private discount rate. Cost-Benefit Analysis: Background – Definition of a project, Stages in project planning, The need for CBA, Efficiency Pricing, The choice of the numeraire (UNIDO, OECD approaches), Estimation of accounting prices (Traded and non-traded goods, Factors of production, Non-traded outputs and external effects); Social Pricing – Social time preference rate, CRI, SARI, Value of public investment, SOC of capital, Distributional weights, Social wage rate, Case studies.

Choice of Policy Instruments for Controlling Pollution, Taxation and Optimal Pollution, Environmental Standards, Taxes and Subsidies, marketable Permits. Benefit–Cost Analysis, Measuring Environmental Damage, Total Economic Value, Valuation Methodologies, discounting the Future. Exhaustible Resources, Measuring and Mitigating Natural Resource Scarcity. Renewable Resources and Species Extinction, Renewable Resources, the Extinction of Species.

RECOMMENDED READING

Irvin, G., Modern Cost-Benefits Methods, Chapters I, IV – VIII, 1997

Brent, R., Project Appraisal for Developing Countries, Part One, 1998

Saerbeck, R., Different Approaches to the Estimation of Economic Conversion Factors, European Investment Bank, 1999

ASSESSMENT METHODS: Written exam

BEM.531 - **Project Appraisal** (3 ECTS)

LECTURER: Dr. Ioannis Karmokolias

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Specialisation in financial, economic and social appraisal of investment projects.

PREREQUISITES: Students must have completed the course on "Mathematics for Decision Making"

COURSE CONTENTS

Financial, economic and environmental appraisal of investment projects. Identification, preparation, appraisal, financing and implementation agreements, supervision, monitoring and evaluation phases in appraising agricultural investment projects

RECOMMENDED READING

Karmokolias Y., Appraisal of Investment Projects Manual, A Series of lectures covering the basic methodology of how to appraise investment opportunities, 1997

Karmokolias Y., Cost Benefit Analysis of Private Sector Environmental Investments: A Case Study of the Kunda Cement Factory, IFC Economics Department Discussion Paper 30, September 1996. Available on the web at http://www.ifc.org/economics/

ASSESSMENT METHODS: Written exam, Project Presentation

BEM.540 - **Principles of Management** (3 ECTS)

LECTURER: Prof. Marios Katsioloudes

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Concepts and applications on principles of management.

PREREQUISITES:

COURSE CONTENTS

The scope of management. The process of management, planning, organisation, directing, controlling. The functional areas of management: production management, financial management, personnel management. Information systems: Electronic Data Processing (EDP), Management Information Systems (MIS), Decision Support System (DSS).

RECOMMENDED READING

Griffin R.W., Management, Houghton Mifflin, 7th Edition, 2002

ASSESSMENT METHODS: Written exam

BEM.541 - **Operations Research** (3 ECTS)

LECTURER: Dr. Michael Doumpos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Developments on operations research.

PREREQUISITES: Students must have completed the course on "Mathematics for Decision Making"

COURSE CONTENTS

The scope of Operation Research/Management Science. The operations Research/Management Science Methodology. Linear Programming, Networks, Dynamic Programming, The Monte Carlo method. Multiple criteria decision-making methods. Information systems in Operations Research. Management Information System, Decision Support Systems, Expert Systems. Link between Management problems and Operations Research.

RECOMMENDED READING

Hillier, F.S. and Lieberman, G.J., Introduction to Operations Research, 8th Edition. McGraw-Hill, New York, 2004.

Jensen, P.A. and Bard, J.F., Operations Research Models and Methods. John Wiley, New York, 2003

H.A. Taha. Operations Research: An Introduction, 7th Edition. Pearson Eduction, Saddle River, New Jersey, 2003

Whiston, W.L., Operations Research: Applications and Algorithms, 3rd Edition, Duxbury Press, Belmont, CA, 1994

ASSESSMENT METHODS: Written exam

BEM.550 - **Market Structure – Price Analysis** (6 ECTS)

LECTURER: Prof.Yannis Katsoulacos and Prof. John Kitromilides

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Specialisation on market structure and behaviour of product prices.

PREREQUISITES: Students must have completed the courses on "Resource and Welfare Economics", and "Supply and Demand Theory/Market Models"

COURSE CONTENTS

Markets: Perfect competition, monopoly. Game theory and oligopoly models: Cournot, Bertrand, Stackelberg, Monopolistic competition. Economics of information: Moral Hazard, Adverse Selection, Contract theory. Vertical integration and vertical restraints

The supply and demand characteristics of food products. Behaviour of food product prices. Temporal and spatial price relationships. Analysis of marketing margins. Supply response models. Single and multi-equation demand models

RECOMMENDED READING

Varian, H., Intermediate Microeconomics, 1996, Chapters 1, 22, 23, 25, 26

Varian, H., Microeconomic Analysis, 2nd edition, 1990, Chapter 2

ASSESSMENT METHODS: Written exam

BEM.551 - **Macroeconomics** (3 ECTS)

LECTURER: Prof. Konstadinos Mattas

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Fundamental concepts on macroeconomics

COURSE CONTENTS

National income and product accounts. National income determination model, consumption and investment. Monetary, fiscal, income policy and agriculture nexus. Demand for money supply, interest and exchange rate, inflation and links with agriculture. Input/output prices and farm/nonfarm price ratio and the cost-price squeeze in agriculture. Interdependency between agricultural and non-agricultural sectors. Aggregated and sector multipliers. Applying macro and interindustry concepts to agriculture (trade, investment, finance, food processing, etc.).

RECOMMENDED READING

William Branson, Macroeconomic Policy. HarperCollins Collage Div., 1989

Rudiger Dornbush, Stanley Fisher, Richard Startz, Macroeconomics. Mc Graw Hill, 1998

Gregory Mankiw, Macroeconomics, Harvard University, 1997

Huw David Dixon, Controversies in Macroeconomics: Growth, Trade and Policy. Blackwell Publishers, 2000

Agenor P.R. and Montiel P. J., Development of Macroeconomics. Second Edition, Princeton University Press, 1999

Romer D., Advanced Macroeconomics. McGraw Hill, 1996

Blanchard J. O. and Fisher S., Lectures in Macroeconomics. MIT Press, 1996

ASSESSMENT METHODS: Written exam

BEM.552 - **Econometrics and Time Series Analysis** (3 ECTS)

LECTURER: Prof. Yannis Bilias

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Theoretical concepts and applications on econometrics and time series analysis.

PREREQUISITES: Students must have completed the courses on "Parametric and Non-Parametric Statistics" and "Research Techniques"

COURSE CONTENTS

Simple and multiple linear regression models. Estimation subject to linear constraints. Specification error. Heteroscedasticity, autocorrelation, multicollinearity and errors in variables. Pooling time-series and cross-section data. Simultaneous equation models, identification and estimation. Distributed lag models, finite and infinite lag models and estimation. Single equation forecasting. Dummy variables. Agricultural supply response models.

Time series decomposition (trend, cyclical and seasonal variation). Box-Jenkins methodology. Partial autocorellations. Vector Autoregressions (VAR models). The case of stationary and non-stationary series. Applications to forecasting.

RECOMMENDED READING

Stock and Watson, Introduction to Econometrics, 2003, chapters 4, 5, 6, 12

ASSESSMENT METHODS: Written exam

BEM.553 - **Food Economics** (3 ECTS)

LECTURER: Prof. Murray Fulton

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Concepts and developments on food economics

PREREQUISITES: Students must have completed the courses on "Market Structure" and "Price Analysis"

COURSE CONTENTS

Basic supply and demand conditions, Concentration, Classification of the Industries, Market channels, Economies of Scale and Mergers. Product differentiation and advertising, Diversification, Barriers to entry and limit price, Market performance and Public policy in the Food Industries.

RECOMMENDED READING

Fulton M. and Gibbings J., Food Economics, Response and Adaptation. Canadian Agricultural Co-operatives in the 21st Century, Centre for the Study of Co-operatives, University of Saskatchewan, 2000.

Fulton M., Economics of Co-operatives. Class Notes, Economics 231.3, Centre for the Study of Co-operatives, University of Saskatchewan, 1998.

Fulton M. and Giannakas K., Organizational Commitment in a Mixed Oligopoly: Agricultural Co-ops and IOFs, 2001.

Boehlje M., US Agriculture in an Increasingly Competitive Global Market, Staff Paper #02-06, Purdue University, 2002.

ASSESSMENT METHODS: Written exam

BEM.554 – **Agricultural Marketing and Policy** (3 ECTS)

LECTURER: Prof. Christopher Ritson

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Analysis of agricultural policies

PREREQUISITES: Students must have completed the courses on "Market Structure" and "Price Analysis"

COURSE CONTENTS

Background to agricultural policy: agricultural product market, agricultural policy analysis, objectives, mechanisms and market effects as a method for analysing agricultural policies. The objectives of the Common Agricultural Policy. Marketing and agriculture. Agricultural policy mechanisms and the measurement of policy effects. Policy reform: price support, direct payments and decoupling, CAP case study. Food policy.

RECOMMENDED READING

Ritson, C., Seminar on Agricultural Marketing and Policy - Food Marketing and Agricultural Marketing: The Scope of the Subject of Agro-Food Marketing in Padberg, Ritson and Albisu (Eds), Agro-Food Marketing, CAB International, 1997.

Refer also to selected parts of chapters 3, 4 and 7 of Agro-Food Marketing.

Ritson, C., Marketing, Agriculture and Economics, Journal of Agricultural Economics, Vol 48 No 3, 1997.

Ritson, C., and Mai, L.W., The Economics of Food Safety, Nutrition and Food Science 4/5, 1998.

Ritson, C., A Coherent Food and Nutrition Policy in Burns, J., McInerney, J. and Swinbank, A. (Eds) The Food Industry: Economics and Policies, Heinemann, 1983.

Ritson, C., Consumer Attitudes to Food Safety as a Quality Attribute: Implications for Food Risk Communication. Paper presented to the 83rd EAAE Seminar, MAICh September 2003.

ASSESSMENT METHODS: Written exam

BEM.555 - **Financial Management** (3 ECTS)

LECTURER: Prof. Constantinos Zopounidis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Developments and knowledge on financial analysis

PREREQUISITES: Students must have completed the course on "Principles of Management"

COURSE CONTENTS

The role of finance. Financial analysis of the farm business: the balance sheet, income statement, cash flow statement, ratio analysis, spread sheet analysis. Financing the growth of the farm: use of debt, business risk and financial risk. Time value of money and capital budgeting, capital requirements of the farm, capital sources of the farm business, loans, cost of capital and optimal structure, risk analysis.

RECOMMENDED READING

Brealey, R.A. and Myers, S.C., Principles of Corporate Finance, 6th Edition, McGraw Hill, 1999.

Ross, S.A., Westerfield, R.W. and Jaffe, J., Corporate Finance, 4th Edition, Irwin, 1996.

Diacogiannis G., Financial Management: A Modelling Approach using spreadsheets, McGraw-Hill, 1994.

ASSESSMENT METHODS: Written exam

BEM.560 - **Management of Business Cooperatives** (3 ECTS)

LECTURER: Prof. dr. ir. Gert van Dijk

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Fundamental concepts and applications of co-operative organisation.

PREREQUISITES: Good knowledge on Microeconomics and Macroeconomics is required

COURSE CONTENTS

Definition and objectives of co-operatives. Introduction to the fundamental concepts of co-operative organisation. Application of firm theory in agribusiness co-ops. Co-operatives vs. private enterprise(s). Economic behaviour of marketing sales and producer's co-operatives under different market structures. Co-operatives and economic efficiency. Internal structure and management of co-operative units. Special issues, taxation, membership policy and relations with the State. Merger policy in agribusiness co-ops.

RECOMMENDED READING

Egerstrom L., Bos P. and van Dijk G., Seizing Control, The International Market Power of Cooperatives, Lone Oak Press, Ltd., 1996.

Henk de Haan & Norman Long (eds), Images and Realities of Rural Life, Wageningen Perspectives on Rural Transformations, Van Gorcum & Comp. B.V., 1997.

Jan Douwe van der Ploeg & Gert van Dijk (eds), Beyond Modernization, The Impact of Endogenous Rural Development, Van Gorcum & Comp. B.V., 1995.

Onno-Frank van Bekkum & Gert van Dijk (eds), Agricultural Co-operatives in the European Union, Trends and Issues on the Eve of the 21st Century, Van Gorcum & Comp. B.V., 1997.

Jerker Nilsson & Gert van Dijk (eds.), Strategies and Structures in the Agro-food Industries, Van Gorcum & Comp. B.V., 1997.

ASSESSMENT METHODS: Written exam

BEM.561 - **Strategic Management** (3 ECTS)

LECTURER: Prof. Costas Markides

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Basic principles and applications on industry and competitive analysis.

PREREQUISITES: Good knowledge of Macroeconomics is required

COURSE CONTENTS

Basic principles of good management—how to start a new company, how to develop and implement its strategy, how to expand the company, and how to be a leader in this company. The course will also introduce the functional specialties of a company, in particular Marketing and Finance.

RECOMMENDED READING

Robert Grant: Contemporary Strategy Analysis, 4th edition, 2002, chapters 2, 3.

Costas Markides: All the Right Moves, 1999, chapters 1, 3, 6.

ASSESSMENT METHODS: Written exam

BEM.562 - **Marketing** (3 ECTS)

LECTURER: Prof. George Baltas

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Basic concepts on marketing system

PREREQUISITES: Good knowledge on Statistics, Econometrics, Microeconomics and Macroeconomics is required

COURSE CONTENTS

Marketing system and process, functional, institutional, behavioural, commodity and structure - conduct - performance approach. Consumer theory and marketing system. Food industry and major trends and issues: specialisation, diversification, decentralisation, wholesaling and retailing industries; dynamics of competitive advantages. Pricing efficiency: factors and dynamics of

marketing margins, transfer costs. Marketing strategies, advertising, promotion, product differentiation, market segmentation and vertical co-ordination. Market information. Standardisation and grading. Transportation. Storage. Food marketing regulations. International food market and marketing.

RECOMMENDED READING

Kotler, P., Marketing Management, Prentice-Hall, 2000
Dalrymple, D.J. and Parsons, L/J., Marketing Management: Text and Cases, J. Wiley, 1995
Evans, J.R. and Berman, B., Marketing, Prentice-Hall, 1997

ASSESSMENT METHODS: Written exam

BEM.563 - **Market Research** (3 ECTS)

LECTURER: Prof. Athanasios Kouremenos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Specialisation and applications on marketing research.

PREREQUISITES: Students must have completed the course on "Marketing"

COURSE CONTENTS

Marketing research and questionnaire design. Sampling procedure. Measurement and causality. Data collection instruments. Data analysis. Applications of marketing research.

RECOMMENDED READING

ASSESSMENT METHODS: Written exam

Computer Laboratory

The Computer Laboratory posses nine workstations, two network connected heavy-duty laser and one colour inkjet printers. All workstations are secured connected to internet through static IP and intranet through Novell and netBEUI protocols. They are using the latest version of Operating system (Windows XPsp1) and running the appropriate Office suite.

For the statistical, mathematical and economical analysis of the educational and research needs the department employs various specialized software, such as JMP 4.0 and SPSS 10.0 for general statistical analysis, Eviews and TSP for Econometric computations and SuperLINDO and SuperLINGO for operational research. As overall statistical software covering a wide range of analysis the department has a license of SAS 8.02.

MASTERS OF SCIENCE PROGRAM

Research Project (9 month duration)

Research Subject Areas (topics generally available for Master of Science thesis)**:**

- Economic Analysis
- Quantitative Analysis
- Cost Benefit Analysis
- Management Studies
- Financial Management
- Market Research
- E-Commerce
- Web Based Surveys

Indicative master thesis realized within the area

TITLE: The Competitiveness of the Portuguese Wine Sector and a Case Study of Exports and Activity Diversification in the Vinhos Verdes Region (2005)
AUTHOR: Sandra Paula Fortunas, Economics, Portugal
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Marios Katsioloudes and Prof. Francisco Diniz

TITLE: A Multicriteria Approach in Detecting Falsified Financial Statements: Evidence from Small and Medium UK Companies (2005)
AUTHOR: Maria Afrokh, Management, Morocco
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Constantinos Zopounidis

TITLE: Consumer attitudes towards nutrition labelling (2005)
AUTHOR: Dimitra Bikou, Marketing, Greece
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. George Baltas

TITLE: Bargaining between unequals: Romania's power in negotiation on the accession terms in agriculture (2005)
AUTHOR: Nicoleta Florentina Girbea, Agricultural Economics, Romania
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Murray Fulton

TITLE: Econometric Analysis of the Turkish Olive Oil Sector with Special Reference to E.U. Membership (2004)
AUTHOR: Dilsen Oktay, Food Engineering, Turkey
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Gert van Dijk

TITLE: Online survey: The case of fresh vegetables in Germany (2004)
AUTHOR: Delina Hoxha, Agricultural Economics, Albania
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Andronikos Mauromoustakos

TITLE: The role of quality in industry concentration: The case of the Greek dairy industry (2003)
AUTHOR: Lampros Lamprinakis, Agricultural Economics, Greece
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Murray Fulton

TITLE: Portfolio Optimization with Mean Variance and Mean Absolute Deviation Models. The Case of S&P 500 (2003)
AUTHOR: Paul Kazarian, Business Administration, Lebanon
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISORS: Prof. Panos Pardalos and Prof. Athanasios Migdalas

TITLE: Assessing country risk using multicriteria classification approaches (2002)
AUTHOR: Etleva Gjonca, Finance, ALbania
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Constantinos Zopounidis

TITLE: Measuring consumer satisfaction, consumption patterns and consumer attitudes towards organic greenhouse products compared with conventional ones (2002)
AUTHOR: Ahmed El Kharboutly, Comerse, Egypt
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Ioannis Siskos

TITLE: The role of commercial banks in development: The case study of Armenia (2001)
AUTHOR: Hakob Mnatsakanyan, Economics, Armenia
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Angelos Kanas

TITLE: Traditional products on the Internet (2001)
AUTHOR: Marisa Roriz Ferreira, Management, Portugal
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Francisco Diniz

TITLE: Decision making under uncertainty: The application of target MOTAD and QP models to determine the efficient use of resources on the island of Crete (2000)
AUTHOR: Brahim Bouras, Agricultural Economics, Morocco
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Panos Pardalos

TITLE: 1992 Common Agricultural Policy Reform and its Impact on Greek Olive Oil Market (2000)
AUTHOR: Houcine Dadi, Agricultural Economics, Tunisia
PLACE OF REALIZATION: Department of Business Economics and Management, MAICh, Chania, Greece
THESIS SUPERVISOR: Prof. Yannis Kitromilides

References of the main academic staff teaching within the M.Sc.

CANADA

Higher Education Institutions

- Murray FULTON, Univ. of Saskatchewan, Saskatoon
- Timothy Beatty, Univ. of Brithish Columbia

CYPRUS

Higher Education Institutions

- Yannis BILIAS, Univ. of Cyprus, Nicosia

DENMARK

Higher Education Institutions

- Kostas KARANTININIS, The Royal Veterinary and Agricultural Univ., Copenhagen

GREECE

Higher Education Institutions

- Konstadinos MATTAS, Aristotle Univ. of Thessaloniki
- Yannis KATSOULACOS, George BALTAS, Athens Univ. of Economics and Business
- Emmanouil PETRAKIS, Anastasios XEPAPADEAS, Angelos KANAS, Univ. of Crete, Rethimno
- Constantinos ZOPOUNIDIS, Athanasios MIGDALAS, Michael DOUMPOS, Technical University of Crete, Chania
- George CHRYSSOCHOIDIS, Agricultural Univ. of Athens
- Athanasios KOUREMENOS, Univ. of Pireaus

THE NETHERLANDS

Higher Education Institutions

- Gert VAN DIJK, Wageningen Univ. and Nyenrode Univ.

UNITED KINGDOM

Higher Education Institutions

- Christopher RITSON, Newcastle Univ.
- Costas MARKIDES, London Business School
- Yannis KITROMILIDES, Greenwich Univ.

UNITED STATES

Higher Education Institutions

- Panos PARDALOS, Univ. of Florida
- Marios KATSIOLOUDES, Saint Joseph's Univ., Philadelphia
- Spiro STEFANOU, Pennsylvania State Univ.
- Andronikos MAUROMOUSTAKOS, Arkansas Univ.
- Joost, M.E. Pennings, University of Illinois at Urbana-Champaign

International Institutions

- Ioannis KARMOKOLIAS, International Finance Corporation, World Bank, Washington

The Institute reserves the right to replace its visiting faculty according to its evaluation process.

Environmental Management

Postgraduate Specialisation and M.Sc. Programme

SCIENTIFIC COORDINATOR: **Dr. Ioannis Manakos**

EDUCATIONAL AND PROFESSIONAL GOALS

The programme of Environmental Management focuses on the ever growing demand for highly specialized and effectively trained scientists to tackle significant environmental issues in today's natural environment, agro-environmental issues and land use functions. Graduates, professionals and specialists from the Mediterranean and Balkan region majoring in a compatible discipline and background knowledge on Environmental issues have the opportunity to specialize on:

- Geographical Information Systems and Remote Sensing, their application to Environmental Management and other problems related to Environment,
- Utilization of quantitative and decision support tools to environmental impact assessment within the environmental policy and legislative framework of the European Union.

In this context and according to CIHEAM's academic regulation, the postgraduate spesialisation programme (1st year) delivers the following educational sections:

- Geographic Information Systems and Spatial Statistics.
- Remote Sensing and Image Modelling.
- Ecology & Management of Environmental Resources.
- Integrated Environmental Analysis using GIS/RS.
- Environmental Impact Assessment, Planning and Management

The qualified second year graduates (Master of Science Degree canditates) pursue their research in an environment fully equipped with modern facilities and the most recently updated software. Research addresses spearhead topics supporting national and EU Environmental policies within an interdisciplinary international scientific network.

Already undertaken research concerns:

- Desertification Monitoring,
- Environmental Resource Management,
- Environmental Impact Assessment,
- Landscape Ecology,
- Soil Erosion Risk Assessment,
- Agricultural Practices Monitoring,
- Precision Agriculture,
- Forest Fire Risk Assessment
- Fire Behaviour Modelling & Effectiveness of Fire Retardants,
- Management of Mediterranean Ecosystems, and
- Regional and Rural Development

The scientific results of graduate studies are usually announced in International Conferences and/or published in World Renowned Journals.

Students successfully completing the two year study and research program are awarded the M.Sc. Degree.

ACCESS TO FURTHER STUDIES

Statistics show that 28% of M.Sc. graduate students are accepted to Ph.D. programmes with full scholarship in European and North American Universities.

POST GRADUATE SPECIALISATION PROGRAMME

The programme is organized in 6 sections

Section I - Introductory (English, Computers)

Section I is devoted to the fundamentals of English grammar, oral communication and the development of academic writing skills. It is also devoted to the supportive tools for environmental analysis, such as microcomputers, computer networks, communication protocols and database management.

Section II - Geographic Information Systems and Spatial Statistics

Section II is devoted to Spatial Statistics and GIS. Theoretical concepts of Geographic Information Systems are presented and students are trained with case studies on soil, wildfires, rangelands, watershed, forest, agrosystems, landscapes and water. It also deals with univariate and multivariate statistical analysis.

Section III - Remote Sensing and Image Processing

Section III is devoted to Remote Sensing and Image Processing. Theoretical concepts are presented and students are trained with case studies on soil, wildfires, rangelands, watershed, forest, agrosystems, landscapes and water.

Section IV - Ecology and Management of Environmental Resources

Section III deals with Soil and Water Resource Management, the Ecology and Management of the Environmental Resources and Agricultural Systems.

Section V - Integrated Environmental Analysis Using GIS/RS

Section V deals with Quantitative Analysis of Mediterranean Ecosystems, using vegetation indexes and involving ecosystematic approximation, ecological mapping for land use planning, site evaluation, productivity and dynamics of ecosystems. It also deals with Environmental Impact Assessment and Strategic Environmental Assessment.

Section VI - Environmental Impact Assessment, Planning & Management

Section V involves Spatial Planning and Environmental Impact Assessment, Environmental Legislation, techniques, methods and applications as well as related Environmental and Natural Resource Economics.

TRAINING SEQUENCE

Section I - Introductory (English, Computers) [4 ECTS]
October

ENM.501 - Scientific English (3 ECTS)

ENM.502 - Information Technologies and Database Management (1 ECTS)

Section II - Geographic Information Systems and Spatial Statistics [21 ECTS]
from October to December

ENM.511 - Statistics (3 ECTS)

ENM.512 - Spatial Statistics - Theory (3 ECTS)

ENM.513 - Spatial Statistics - Practice (3 ECTS)

ENM.514 - GIS Theory (3 ECTS)

ENM.515- GIS Analysis & Applications (3 ECTS)

Section III - Remote Sensing and Image Processing [15 ECTS]
from December to February

ENM.521 - Remote Sensing Theory (3 ECTS)

ENM.522 - Basic Geodesy and Digital Photogrammetry (3 ECTS)

ENM.523 - Digital Image Analysis (3 ECTS)

ENM.524 - Remote Sensing Applications (3 ECTS)

ENM.525 - Integrated GIS/RS Case Studies (3 ECTS)

Section IV - Ecology and Management of Environmental Resources [11 ECTS]
from February to March

ENM.531 - Mediterranean Agricultural Environments (3 ECTS)

ENM.532 – Management of Grasslands and Phryganic Ecosystems (3 ECTS)

ENM.533 – Management of Shrublands and Forests (3 ECTS)

ENM.534 - Soil & Water Resource Management (3 ECTS)

Section V - Integrated Environmental Analysis Using GIS/RS [9 ECTS]
March to May

ENM.541 - Quantitative Analysis of Mediterranean Ecosystems (3 ECTS)

ENM.542 - Landscape Ecology and Environmental Modelling (3 ECTS)

ENM.543 - Decision Support Using GIS (3 ECTS)

Section VI - Environmental Impact Assessment, Planning & Management [9 ECTS]
May to June

ENM.551 - Spatial Planning and Environmental Assessment (3 ECTS)

ENM.552 - Environmental Legislation (3 ECTS)

ENM.553 - Environmental & Natural Resource Economics (3 ECTS)

COMPREHENSIVE ORAL OR WRITTEN EXAMINATION (MODALITIES AND DATES)

During Section I, participants take a written examination and a computer assisted examination, each unit being independently graded.

For section II, participants take 1 written examination, 3 computer assisted examinations and present a written project for evaluation of the unit GIS Applications. Examinations are equally distributed over time, each unit being independently graded.

For Section III, participants take 2 written examinations, 1 computer assisted examination and present a written project for evaluation of the units Remote Sensing Applications and Integrated GIS/RS Case Studies. Examinations are equally distributed over time, each unit being independently graded.

For Section IV, participants take 4 written examinations and present a written project for evaluation of the unit Mediterranean Agricultural Environments. The Examinations are equally distributed over time, each unit being independently graded.

For Section V, participants present written projects for evaluation of the units Quantitative Analysis of Mediterranean Ecosystems, Landscape Ecology & Environmental Modelling and Decision Support Using GIS. The Examinations are equally distributed over time, each unit being independently graded.

For Section VI, participants take 2 written examinations and present a written project for evaluation of the unit Spatial Planning & Environmental Assessment. The Examinations are equally distributed over time, each unit being independently graded.

Written exams consist of a set of questions that require a concise answer. Some of the questions are multiple choice. Lengthy questions are avoided.

A comprehensive oral exam will be conducted individually at the end of Section VI.

ANALYTICAL SYLLABUS

ENM.501 - **Scientific English** (3 ECTS)

LECTURER: Ms. L. Lucas

TYPE OF COURSE AND TEACHING METHODS: Lectures, Seminars

OBJECTIVE OF THE COURSE: Development of academic writing, public speaking and communicating with the scientific society.

PREREQUISITES: Fluency of the English language (TOEFL level)

COURSE CONTENTS

Note-taking skills in order to better understand lectures; the study of scientific texts and their development; terminology related to the students' chosen field; a review of the fundamentals of English grammar with a view to studying advanced grammar skills for the purposes of writing a Postgraduate thesis; development of academic writing skills; public speaking, communication skills and theme-related discussions based on the students' chosen field of study. The final grade is awarded on the basis of the following:

- examination marks (based on grammar and scientific texts);
- presentation marks (based on oral and written presentations of students' own work);
- participation in classwork and attendance; homework assignments.

RECOMMENDED READING

Papers provided by the Instructor.

ASSESSMENT METHODS: Written exam, Quiz

ENM.502 - **Information Technologies and Database Management** (1 ECTS)

LECTURER: Dr. P. Drakos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Skill development and hands-on experience with computer networks, communication protocols, and database management.

PREREQUISITES: Basic knowledge of computer hard- and software.

COURSE CONTENTS

Introduction to microcomputer architecture hardware and operating systems (DOS, WINDOWS). Scientific and productive applications run on personal computers. Hands–on experience. Networking and communication protocols. Type of data, information, scale of measurements, records and files, electronic data sheets, hierarchical databases, relational databases object oriented databases, knowledge databases, programming with MSAccess database.

RECOMMENDED READING

European Computing Driving Licence.

ASSESSMENT METHODS: Computer-Assisted Exam, Quiz

ENM.511 - **Statistics** (3 ECTS)

LECTURER: Prof. G. Markakis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Skill development and hands-on experience with the basic concepts of statistics along with statistical software packages.

PREREQUISITES:

COURSE CONTENTS

Basic terms and concepts in Statistics. Descriptive statistics:

- Measures of central tendency
- Measures of dispersion and variability
- Measures of shape or relative position

Inferential problem solving and statistics, estimation of the mean and the variance, confidence interval estimation, comparison of the means (t test, one and two way ANOVA). Probabilities and distributions:

- Probabilistic and deterministic processes (basic terms and concepts)
- Binomial distribution
- Poisson distribution
- normal distribution
- x2, t and F distributions

Sampling (basic concepts):

- Populations and samples
- Types of probability sampling
- Basic concepts in estimation in sampling
- Confidence intervals and estimation
- Sample size selection

Traditional Hypothesis testing (inferential) and test selection:

- P value or Prob value Hypothesis testing
- One sample difference of means test (small sample)
- One sample difference of proportions test

Two sample and matched pairs (dependent sample) difference tests:

- two sample difference of means test
- two sample difference of proportions test
- matched pairs (dependent sample) difference tests
- Three or more sample difference tests, analysis of variance (ANOVA).

Goodness of fit and categorical difference tests:

- goodness of fit tests
- contingency analysis and tables
- x2 tests of independence

Statistical relationship between variables (linear regression and correlations). Correlation, its nature and related issues:

- autocorrelation
- interval vs. ratio variables
- ordinal variables

Regression:

- the form and strength of relationship in bivariate regression
- residual or error analysis in bivariate regression
- inferential use of regression
- multiple regression

RECOMMENDED READING

Dixon W.J., Massey F.J. 1983. Introduction to Statistical Analysis. McGraw-Hill.

Draper N., Smith H. 1980. Applied Regression Analysis. (2nd Ed.). Wiley. 709 pp.

Everitt B.S. 1977. The analysis of contingency tables. Chapman & Hall.

Fowler J., Cohen L. 1990. Practical statistics for field biology. J. Wiley.

Krebs C.J. 1989. Ecological Methodology. Harper & Row, New York.

Milton J.S., Tsokos J.O. 1983. Statistical Methods in Biological & Health Science. McGraw- Hill.

Ott L. 1988. An introduction to Statistical Methods & Data Analysis. PWS-Kent. Boston.

Snedecor G.W., Grochran W.G. 1989. Statistical Methods. (8th ed.). Iowa State Univ. Press.

Steel R.G.D., Torrie J.H. 1980. Principles & procedures of Statistics with Special Reference to the Biological Sciences. (2nd ed.). McGraw-Hill, N.Y.

Zar, J.H. 1984. Biostatistical Analysis. (2nd Ed.). Prentice-Hall, Eglewood Cliffs, N.J.

ASSESSMENT METHODS: Computer-Assisted Exam, Quiz

ENM.512 - **Spatial Statistics - Theory** (3 ECTS)

LECTURER: Prof. G. Markakis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Advanced skill and knowledge development on Statistics.

PREREQUISITES: Advanced knowledge and skills on Statistics and GIS.

COURSE CONTENTS

Basic statistical concepts in geography (statistics and maps), the context of statistical techniques (with examples), characteristics and preparation of geographic data (selected dimensions, concepts and levels of measurement, classification methods, graphic procedures), geographic problem solving situations and scenarios.

The differences between classical and spatial statistics through techniques which account for geographical position, with emphasis to the most common methods of data visualisation, exploration and modelling.

Spatial data and descriptive statistics:

- Spatial mean
- Spatial Measures of central tendency
- Spatial Measures of dispersion
- Locational issues

Probability mapping (see STATS1).

Spatial sampling (see STATS1), inference and applications:

- Spatial universes and populations
- Sampling fundamentals and strategies
- Sampling a continuous universe
    - Point sampling of a continuous population
    - Areal sampling of a continuous universe

Inferential spatial statistics and spatial pattern analysis (see also STATS1):

- Point pattern analysis
- area pattern analysis

Analysis of Area data:

- indices of segregation and isolation
- principal components analysis (PCA)
- correspondence analysis
- cluster analysis
- factor analysis
- discrete analysis

Statistical relationship between variables (see STATS1):

- correlation and types of variables (interval, ratio and ordinal variables):
    - autocorrelation and thumb rules, to visualize spatial dependence
    - map complexity
    - use of correlation indices in map comparison
- regression (see STATS1):
    - multivariate regression, extrapolation from the bivariate regression in STATS1

Statistical models and the Geographic Weights Matrix:

- evaluation criteria:
    - mean response estimation
    - variance estimation
    - spatial autoregressive parameter "rho" (ρ) estimation

Aggregation effects in georeferenced data:

- spatial dependency of spatial data analysis
- spatial dependence and the averaging process
- impact of the Modifiable Areal Unit Problem (MAUP) on spatial data
- approaches to solving the MAUP
- analyzing data from different scales

Spatial statistics for the analysis of variance:

- autoregressive (AR) response model
- AR based and conventional ANOVA

RECOMMENDED READING

Bailey, T.C. and A.C. Gatrell. 1995. Interactive Spatial Data Analysis. Longman Group Limited.

Dilon, W.R. and Goldstein M. 1984. Multivariate Analysis. Methods & Applications. Wiley.

Gauch, H.G. 1982. Multivariate Analysis in Community Ecology. Cambridge University Press.

Jackson, J.E. 1991. A User's Guide to Principal Components. Wiley.

Jilocoeur, P. 1963. The multivariate generalization of the allometry equation. Biometrics 19: 497-499.

Jolicoeur, P. and Mosimann, J.E. 1960. Size and shape variation in the painted turtle: a principal component analysis. Growth 24: 339-354.

Jollife, I.T. 1986. Principal Components Analysis. Springer-Verlag, NY.

Morrison, D.F. 1991. Multivariate Statistical Mehtods. (3rd ed.). McGraw-Hill.

Pielou, E.C. 1984. The interpretation of Ecological data. Wiley.

Johnson, R.A. and D.W. Wichern. Applied Multivariate Statistical Analysis. Third Edition. Prentice-Hall International. Inc.

ASSESSMENT METHODS: Computer-Assisted Exam

ENM.513 - **Spatial Statistics - Practice** (3 ECTS)

LECTURER: Prof. A. Mavromoustakos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Hands-on experience with Spatial Statistics working on realistic situations.

PREREQUISITES: Knowledge and skills on Spatial Statistics

COURSE CONTENTS

Computer applications using S PLUS, JMP, SPSS statistical software packages. As a follow-up to STATS1 and SPATIAL STATS, students acquire individualized hands-on experience in powerful computerized tools. Specifically, Statistical Analysis Software (SAS) is used in the following procedures by employing existing research data:

- Regression (Proc. REG) - simple and multiple residual analysis.
- ANOVA (Proc. ANOVA and Proc. GLM) - one-way (multiple comparisons) and two-way (with and without interaction) residual analysis.
- Principal components (Proc. PRINCOMP).
- Factor analysis (Proc. FACTOR).
- Cluster analysis (Proc. CLUSTER).

RECOMMENDED READING

Handbook of Statistical Analysis Using SAS, Edition: 2nd - Author(s): Der, Geoff

ISBN: 158488245X, (http://www.ecampus.com/bk_detail.asp?isbn=158488245X&referrer=frgl)

A Handbook of Statistical Analyses Using S-Plus, Edition: 2nd - Author(s): Everitt, Brian, ISBN: 1584882808, (http://www.ecampus.com/bk_detail.asp?isbn=158488245X&referrer=frgl)

ASSESSMENT METHODS: Computer-Assisted Exam, Quiz

ENM.514 - **GIS Theory** (3 ECTS)

LECTURER: Prof. N. Silleos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Introduction to GIS theory and familiarisation with GIS methods and techniques.

PREREQUISITES: Advanced knowledge Database Management.

COURSE CONTENTS

Basics of geographic data, nature of spatial data, uncertainty in the analysis of geographic phenomena, cartographic databases, informatic databases. Elements of the geographical space and their attributes - data collection, sampling, and encoding (graphic, non-graphic elements). Co-ordinate systems, map projections, and datums. DEM. Digital terrain models (interpolation, extrapolation - automatic contouring - Perspective viewing, analytical hill shading, aspect, slope). GIS components - Data I/O, editing, polygon overlays, Boolean operations, distance operators, map composer. Cartography - thematic map design, spatial data, layer structures, map reproduction. GIS design - data base design, sources of information, data organisation into layers, specifications and accuracy, system development and evaluation. Examples with laboratory assignments (construction of a map by hand, construction of a map using digitiser and computer, construction of DTM, automatic contouring, perspective view, analytical hill shading).

RECOMMENDED READING

Anselin, L., Syabri, I., and Kho, Y. (2004c). GeoDa, an introduction to spatial data analysis. Geographical Analysis. forthcoming.

Bailey, T. C. and Gatrell, A. C. (1995). Interactive Spatial Data Analysis. John Wiley and Sons, New York, NY.

Calvo, E. and Escobar, M. (2003). The local voter: A geographically weighted approach to ecological inference. American Journal of Political Science, 47(1):189–204.

Longley, P.A., Goodchild, M.F., Maguire, D.J., and D.W. Rhind. Geographic Information Systems and Science. John Wiley & Sons, Ltd. ISBN 0-471-49521-2.

Bernhardsen, Tor. Geographic information systems : an introduction / Tor Bernhardsen..-- 2nd ed..-- New York, Wiley : c1999.-- xvi, 372 p. : ill.

Geographical infrormation systems : principles, techniques, applications and management / edited by Paul A. Longley...[et al.]..-- 2nd ed..-- New York, Wiley : c1999.-- 2 v., [40] p. of col. plates : ill., maps

Geographic information systems and science / Paul A. Longley...[et al.]..-- Chichester, John Wiley : 2001.-- xviii, 454 p. : col. ill.

Davis, Bruce E. GIS: a visual approach / Bruce E. Davis..-- 2nd ed..-- Albany, N.Y., Delmar Thomson Learning : 2001.-- x, 437 p. : ill.

Flynn, John J. Inside ArcInfo / Jay Flynn and Teresa Pitts..-- 2nd ed., completely revised for version 8.0 for Windows NT and Unix..-- New York, OnWord Press : 2000.-- xvi, 284 p. : ill. + 1 computer laser optical disk

Burrough, P. A. Principles of geographical information systems / Peter A. Burrough and Rachael A. McDonnell..-- Oxford ;, New York : Oxford University Press1998.-- xiii, 333 p. : ill..-- (Spatial information systems and geostatistics)

ASSESSMENT METHODS: Written exam

ENM.515 - **GIS Analysis & Applications** (3 ECTS)

LECTURER: Prof. N. Silleos, Dr. T. Alexandrides

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Hands on experience in integrating modern GIS methods and techniques for spatial analysis in environmental management.

PREREQUISITES: Knowledge on GIS (theory).

COURSE CONTENTS

Geographic Information System (ArcView, Idrisi applications). Application of G.I.S. Remote Sensing (ERDAS Imagine applications). Case studies of the application of Remote; coastal changes assessment, environmental degradation. Application of remote sensing to monitor agricultural statistics. Application of G.I.S. and Remote Sensing techniques to soil survey data. Case studies of application of Remote Sensing and G.I.S.; land resources changes assessment. Environmental degradation. Multitemporal detection of urbanization growth.

RECOMMENDED READING

Longley, P., Goodchild, M.J. Maguire, D. and D.W. Rhind. Geographic Information Systems and Science. John Wiley & Sons, Ltd. ISBN 0-471-89275-0.

ASSESSMENT METHODS: Project Presentation

ENM.521 - **Remote Sensing Theory** (3 ECTS)

LECTURER: Dr. I. Manakos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Introduction to the physical background, theoretical concepts and operational aspects of Remote Sensing.

PREREQUISITES: Knowledge and skills on Basic Geodesy & Digital Photogrammetry.

COURSE CONTENTS

This course examines electromagnetic radiation and its interaction with the Earth's surface and atmosphere, basic radiative transfer theory, and the performance of passive (i.e. aerial photography, airborne and spaceborne scanner data) and active (i.e. Lidar and SAR imagery) imaging systems.

The course also focuses on aerial photo interpretation, digital image processing and a wide range of satellite and airborne remote sensing technologies (including interferometric synthetic aperture radar, and hyperspectral and thermal infrared imaging). Emphasis is placed on the extraction of quantitative and qualitative information from remote sensing data, the integration of remote sensing and GIS technologies, and the operational aspects of remote sensing.

RECOMMENDED READING

J.R. Jensen Remote Sensing of the Environment, Joseph D. White, Prentice Hall, Texas.544p.

Elachi, C., 1987. Introduction to the physics and techniques of remote sensing, Patrick Eriksson, GEM, Chalmers, Sweden.

Harris, R. 1987 Satellite remote sensing. Patrick Eriksson, GEM, Chalmers, Sweden.

Rees, W.G., 1990. Physical principles of remote sensing. Patrick Eriksson, GEM, Chalmers, Sweden.

Wayne, R.P., 1991. Chemistry of atmospheres. Patrick Eriksson, GEM, Chalmers, Sweden.

Lillesand, Thomas M. And Ralph W. Kiefer, 1994. Remote Sensing and Image Interpretation. John Wiley and Sons, Inc.

ASSESSMENT METHODS: Written exam

ENM.522 - **Basic Geodesy and Digital Photogrammetry** (3 ECTS)

LECTURER: Prof. V. Tsioukas

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Skill development on extraction of topographic features from aerial photographs and satellite imagery.

PREREQUISITES: Knowledge and skills on GIS.

COURSE CONTENTS

This course focuses on the extraction of high-quality topographic information from remote-sensing imagery, in particular on the generation of digital elevation models (DEMs) from stereo aerial photographs and satellite imagery. Material covered includes a review of relevant cartographic issues; the use of GPS; basic principles of photogrammetry, including analog and digital photogrammetry; photogrammetric applications; controls on image quality; preparatory image analysis; automated DEM extraction; post-processing and use of photogrammetrically-acquired data; orthorectification; and recent developments in interactive measurements based on 3-D visualisations of aerial photographs.

RECOMMENDED READING

Compton J. Tucker, Denelle M. Grant, and Jon D. Dykstra. March 2004. Photogrammetric Engineering & Remote Sensing. Vol. 70, No.3. pp.313-322.

ASSESSMENT METHODS: Written exam

ENM.523 - **Digital Image Analysis** (3 ECTS)

LECTURER: Mr. C. Karydas

TYPE OF COURSE AND TEACHING METHODS: Computer-assisted teaching

OBJECTIVE OF THE COURSE: Skill development and familiarisation with digital image processing in remote sensing.

PREREQUISITES: Knowledge and skills on GIS, Spatial Statistics, Basic Geodesy & Digital Photogrammetry and Remote Sensing Theory.

COURSE CONTENTS

The course starts with the investigation of images from the archive (search in the institutional database or over the internet) and ordering procedures. Upon the receipt of the image in the lab, handling of the image with the software available starts. Different image formats are explored and Importing/Exporting techniques are demonstrated. After importing the image in the pc, it can be displayed on the monitor, so Display principles and practice are presented in brief (sense of pixel and resolution, colour generation, image types). To investigate the image on the pc monitor, several tools, such as Zooming and Adjustments, Measurements, and Digital Elevation Model viewing (3D) are shown. Linking viewers geographically or spectrally and Viewing multiple layers (Blend and Sweep techniques are some of the most useful utilities for image investigation and analysis. Next, continuous raster management is presented through Layer combination management, Contrast/Brightness adjustment, common and basic Filters applications, and Spectral, Spatial, and Surface profiles demonstration. A dataset preparation for certain tasks of the analysis is made using functions, such as Image subset, Creation of new images, Mosaic generation, Layer stack, Geometric correction and Reprojection.

Image spectral transformations, which give the researcher the possibility for getting from the image hidden information, are following. Such transformations are the PCA, Vegetation indices and other kind of indices as well, the Decorrelation stretch, the Tasselled cap and the RGB-IHS transformation. When the analysis has resulted desired fruits, the image(s) can be used for a very important operation, namely Classification. In this operation the continuous raster data are transformed into thematic data, in other words into mapping products. In this stage, Image info, statistics, and Spectral space representation are the firs steps. Image clustering, Threshold investigation and

Growing region generation using AOIs are techniques for determining spectral signatures, which on their turn are the basis for supervised classification methodologies. Classification is completed with Accuracy assessment of the thematic products (map). Maps can be shaped, concerning frames and annotation, with the composer module and then can be printed out.

RECOMMENDED READING

Mather, P.M., 1999. Computer processing of remotely-sensed images. Chichester, England, Wiley.
Schrader, S. and R. Pouncy, 1999. Erdas field guide (software handbook), ERDAS Inc., Atlanta: 672.

ASSESSMENT METHODS: Computer-Assisted Exam

ENM.524 - **Remote Sensing Applications** (3 ECTS)

LECTURER: Prof. K. Perakis and Dr. I. Gitas

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Hands-on experience in remote sensing applications.

PREREQUISITES: Advanced knowledge and skills on GIS, Advanced Statistics, Spatial Statistics, Basic Geodesy & Digital Photogrammetry, Remote Sensing and Digital Image Processing.

COURSE CONTENTS

Photo-interpretation of aerial photographs or digital images for: land use, land cover, forestry. Case study on image classification applied to: Land use, Land cover, Forestry. Case studies applications on soil, wildlife, range, watershed, agrosystems, landscape, water, protected areas, natural hazards, pollution.

RECOMMENDED READING

ERDAS Imagine Version 8.6 Field Guide, 2002, Chapter 6.

Lillesand, T, and Kiefer, R., 2000, Remote sensing and image interpretation, 4th Ed.; Wiley Chapter 7.

Mather, P., 1999. Computer processing of remotely sensed images: an introduction. 2nd Ed. 292 pp. Wiley. Chapter 8.

Neural Networks in Remote Sensing, 1997, A Special Issue of the International Journal of Remote Sensing, Vol.18, No 4.

Schowengerdt, 1997, Remote sensing: models and methods for image processing, 2nd ed., Academic Press. Chapter 9.

ASSESSMENT METHODS: Project Presentation

ENM.525 - **Integrated GIS/RS Case Studies** (3 ECTS)

LECTURER: Dr. I. Gitas and Prof. K. Perakis

TYPE OF COURSE AND TEACHING METHODS: Computer-assisted teaching

OBJECTIVE OF THE COURSE: Hands on experience in integrating modern GIS & RS methods and techniques in decision support concerning environmental management.

PREREQUISITES: Advanced knowledge and skills on GIS, Advanced Statistics, Spatial Statistics, Basic Geodesy & Digital Photogrammetry, Remote Sensing (theory and applications) and Digital Image Processing.

COURSE CONTENTS

(The students must be capable after certain hours of training to operate one of the GIS systems)

Case studies on management and decision support of: Soil, wildlife, rangelands, watershed, forest, agrosystem, landscape, water, fire, protected areas, risk and hazards, mitigation and rehabilitation measures.

RECOMMENDED READING

Remote Sensing & Image Analysis tutorial, University of California at Berkeley: http://www.cnr.berkeley.edu/~gong/textbook/chapter1/html/home1.htm

Spectroscopy of Rocks and Minerals, and Principles of Spectroscopy by Roger N. Clark: http://speclab.cr.usgs.gov/PAPERS.refl-mrs/refl4.html

Materials Maps from USGS Spectroscopy Lab: http://speclab.cr.usgs.gov/maps.html

Main page for USGS Spectroscopy Lab: http://speclab.cr.usgs.gov/index.html

NASA's Remote Sensing Tutorial: http://rst.gsfc.nasa.gov/

A beautiful collection of remotely-sensed images of Canada, with interpretations: http://www.ccrs.nrcan.gc.ca/ccrs/learn/tour/tour_e.html

Spectral libraries: http://speclib.jpl.nasa.gov/Search.htm, http://speclab.cr.usgs.gov/browse.html

ASSESSMENT METHODS: Project Presentation

ENM.531 - **Mediterranean Agricultural Environments** (3 ECTS)

LECTURER: Prof. G. Arapis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Introduction to the management of agricultural systems.

PREREQUISITES: Knowledge and skills on GIS, Spatial Statistics, Remote Sensing Theory and Applications.

COURSE CONTENTS

Introduction to Mediterranean agricultural systems, management and environmental implications. Ecological aspects of Mediterranean Agricultural Environments. Pattern development and characteristics of agricultural systems. Classification of agricultural systems. Diachronic land use and pattern changes and their implications to populations, communities and landscapes. Anthropogenic and societal impacts on agriculture. Sustainable management of mediterranean agricultural environments. Operational management approaches. Case studies on the use of GIS/RS in agricultural systems management (Precision Agriculture). Monitoring of agricultural systems in space and time. Good farming applications related to agro-environmental measures and indicators.

RECOMMENDED READING

Ahuja, L.R, L. Ma and T.A. Howell. 2002. Agricultural system models in field research and technology transfer. Lewis Publishers, -a CRC Press Company, Boca Raton, FL. p 357 ISBN 1-56670-563-0.

Peart, R.M and R. B. Curry (eds) 1998. Agricultural systems modelling and simulation. Marcel Dekker, Inc. New York. p. 695 ISBN 0-8247-0041-4.

Turner II, B.L. and S.B. Brush (eds) 1987. Comparative farming systems. The Guilford Press, New York. p. 428 ISBN 0-89862-780-X.

Powers, L. E. and R.McSorley. 2000. Ecological principles of agriculture. Delmar –Thomson Learning, USA. p.430. ISBN 0-7668-0653-7.

Jones, Jr. J. B. 2003. Agronomic Handbook. Management of crops, soils and their fertility. CRC Press LLC. Boca Raton, FL. p.450 ISBN 0-8493-0897-6.

Foth, H.D. and B. G. Ellis. 1997. Soil fertility (2nd ed.) CRC Press. Boca Raton, FL p.289, ISBM 1-56670-243-7.

Anonymous. 2003. Organic agriculture. Sustainability, markets and policies. OECD. CABI Publishing. ISBN 0-85199-740-6

Jones, J. Jr. 2003. Agronomic Handbook. Management of crops, soils and their fertility. CRC Press Boca Raton, FL. p.450, ISBN 0-8493-0897-b

Trudgill, S. T. 1988.Soil and vegetation systems (2nd ed.) Contemporary problems in Geography. Clarendon Press-Oxford. ISBN 0-19-874138-3.

Stelly, M. (ed.) 1976. Multiple cropping. ASA Special Publication No. 27, ASA, CSSA, SSSA, Madison, WI.

Stelly, M. (ed.) 1978. Crop residue management systems. ASA Special Publlication No. 31, ASA, CSSA, SSSA, Madison, WI.

Manion, A.M. 1995. Agriculture and environmental change. John Wiley & Sons, N.Y.

Zeiler, M. 1999. Modelling our world. The ESRI guide to geodatabase design.ESRI Press. Redalands, CA.

Gertsis, A. and G. Vellidis. 2003. Principles of Precision Agriculture. Lecture Notes for the DPACS, AFS, Thessaloniki, ELLAS (Greece).

Westetvelt, J. D and H. F. Reetz, Jr. 2000, GIS in site-specific agriculture. Interstate Publishers, Inc. Danville, IL. ISBN 0-8134-3193-X

Frohn, R. C. 1998. Remote sensing for landscape ecology. Lewis Publishers, an imprint of CRC Press, Boca Raton, FL. ISBN 1-56670-275-5

National Research Council. 1997. Precision Agriculture in the 21st century. Geospatial and information technology in crop management. National Academy Press, Washington, Dc. 1997. ISBN 0-309-05893-7.

Robert. P.C., R. Rust, H. and W.E. Larson. 1996 (eds) Proceedings of the 3rd International Conference on Precision Agriculture. June 23-26, 1996, Minneapolis, MN. ISBN. 0-89118 132-6.

Conacher, A. J. and M. Sala (Eds.). 1998. Land degradation in Mediterranean environments of the world. Nature and extend, causes and solutions. John Wiley & Sons, New York, N.Y. ISBN 0-471-96317-8

Moldan, B. and S. Billharz. (Eds.) Sustainability indicators. Report of the project on Indicators of Sustainable Development. SCOPE No. 58. John Wiley & Sons, New York, N.Y. ISBN 0-471-97352-1

Roda, F. J. Retana, C.A. Gracia and J. Bellot (Eds). 1999, Ecology of Mediterranean evergreen oak forests. Ecological Studies No. 137. Springer-Verlag, Berlin, Germany. ISBN 3-540-65019-9.

Gildemeister, H. 2002. Mediterranean gardening. A waterwise approach. University of California Press, Berkeley, CA. ISBN 0-520-23647-5.

Stamatiadis, S., J.M. Lynch and J.S. Schepers (eds). 2004. Remote sensing for agriculture and the environment. Proceedings of OECD Workshop, Sept. 16-19, 2002. Athens, Greece Peripheral Editions "Ella", Larissa, Greece ISBN 960880008-0.

Harlan, J. R. 1975. Crops and man. ASA, CSSA, Madison, WI. ISBN 0-89118-032-X.

Cunnigham, W. P. and B. W. Saigo. 1997. Environmental science: a global concern. Wm. C. Brown Publishers, IA.

Cunnigham, P. 1994. Understanding our environment. Wm. C. Brown Publishers, IA.

ASSESSMENT METHODS: Project Presentation

ENM.532 – **Management of Grasslands and Phryganic Ecosystems** (3 ECTS) _____

LECTURER: Prof. V. Papanastasis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Field-work

OBJECTIVE OF THE COURSE: The presentation and analysis of the ecology, preservation and management principles relevant to the Mediterranean landscape.

PREREQUISITES:

COURSE CONTENTS

Introduction to Mediterranean environment and its ecosystems. Spatial heterogeneity of grasslands and phryganic ecosystems. Pattern development and characterization. Ecological factors and processes involved. Diachronic land use and pattern changes and their implications to populations, communities and landscapes. Anthropogenic impacts on patterns and changes including grazing, fire, farming, reforestation, conservation measures and social-economic changes. Sustainable management of Mediterranean grasslands and phryganic ecosystems.

RECOMMENDED READING

Heady H.E. and R.D. Child, 1994. Rangeland Ecology & Management, 1994. Westview Press, San Francisco.

Vallentive, J.F., 1971. Range Development and Improvements, 2nd edition. Brigham Young, San Fancisco.

S.Mazzoleni, G.di Pasquale, M.Mulligan, P. Di Martino, F. Rego (Eds), 2004. Recent Dynamics of the Mediterranean Vegetation and Landscape, WILEY, pp 306, ISBN: 0-470-09369-2

B. Redecker, P. Finck, W. Hardtle, U. Riecken and E. Schroder, 2002. Pasture Landscapes and Nature Conservation, Spinger Verlag Heidelberg New York, pp 435, ISBN: 3-540-42920-4

O. Bastan & U. Steinhardt, 2002. Development and perspective of Landscape Ecology, Kluwer Academic Publishers, pp 498, ISBN: 1-4020-0919-4

Jianguo Liu and W.W. Taylor, 2002. Integrating Landscape Ecology into Natural Resource Management, Cambridge University Press, pp 480, ISBN: 052178015-2

J. Makhzoumi and G. Pungetti, 1999. Ecological Landscape Design & Planning, E & FN SPONO, pp 330, ISBN: 0-419-23250-8

E.M. Bignal, D.I. MacCracken and D.J. Curtis (Eds.), 1994. Nature Conservation and Pastoralism in Europe, Joint Nature Conservation Committee, Proceedings of the Third European Forum on Nature Conservation and Pastoralism, pp 156, ISBN: 1-873701-60-8.

ASSESSMENT METHODS: Written exam

ENM.533 – **Management of Shrublands and Forests** (3 ECTS)

LECTURER: Dr. K. Radoglou

TYPE OF COURSE AND TEACHING METHODS: Lectures, Field-work

OBJECTIVE OF THE COURSE: The presentation and analysis of the ecology, preservation and management principles relevant to the Mediterranean landscape.

PREREQUISITES:

COURSE CONTENTS

Features of Mediterranean shrublands and forest, vegetation zones, diversity, natural distribution of the forest, natural succession, climax communities. Problems for Forest land in Mediterranean region (wildfires, grazing drought). Resilience of mediterranean shrub communities to fires. Adaptation (morphological, phenological and physiological) of Mediterranean species to environmental constraints, adaptations.

Sustainable multiple use forestry, Criteria and indicators for sustainable management of forest. Silvicultural systems in Mediterranean area, clearcutting and selective cutting, intermediate treatments, coppice forest. Forest restoration, natural regeneration, reforestation, seeding and planting, site preparation, planting stock quality, transplanting stress and field performance

RECOMMENDED READING

Neeman, G. and Trabaub, L. 2000. Ecology, Biogeography and Management of Pinus halepensis and P. brutia, Forest Ecosystems in Mediterranean Basin. Backghuys Publishers Leiden. The Netherlands, 1-403

Scarascia Mugnozza, G., Oswald, H., Piussi P. and Radoglou, K. 2000. Forest of the Mediterranean region : gaps in knowledge and research needs. Forest Ecology and Management, 132, 97-109.

Keeley J., Fotheringham, C. J. and Baer-Keeley, M. 2005. Determinants of postfire recovery and succession in Mediterranean – climate shrublands of California. 2005. Ecological Applications 15(5) 1515-1534.

Kozlowski, T.T. 2002. Physiological ecology of natural regeneration of harvested and disturbed forest stands: Forest Ecology and Management 158(2002) 195-221.

ENM.534 - **Soil & Water Resource Management** (3 ECTS)

LECTURER: Prof. G. Zalidis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Skill and knowledge development on soil and water resources management.

PREREQUISITES: Knowledge and skills on GIS and Remote Sensing.

COURSE CONTENTS

The course provides a solid training in general biology, physiochemistry, and ecology, techniques that are required to quantify environmental systems, management and planning skills and an

understanding of environmental issues and policy formulation. The course aims to attract people who are interested in environmental management, or who anticipate responsibility for environmental policy formation, or a role in environmental education. The course extends the professional expertise of people working in such fields as agriculture, community welfare, economics, education, engineering, forestry, planning, public health, political economy, science, and resource management. The course covers the following issues:

- Foundations of environmental management
- Natural resources and ecosystem functioning
- Soil and water resources management at watershed level
- Environmental risk assessment
- Pollution and degradation of soil and water resources
- Soil and water resources management in protected areas
- Pollution control technology
- Environmental planning and site analysis using GIS and remote sensing techniques

RECOMMENDED READING

Andrews, S.S., Karlen, D.L. Mitchell, J.P. 2002. A comparison of soil quality indexing methods for vegetable production systems in Northern California. Agr., Ecos. and Envir. 90.

Doran, J.W., Parkin, T.B. 1996. Quantitative indicators of soil quality: a minimum data set. In: Doran, J.W., Jones, A.J. (eds), Methods for Assessing Soil Quality. SSSA Special Pub. 49, Soil. Soc. Am., Madison, WI.

E.P.A. 1992. Manual guidelines for water reuse. EPA/625/R-92/004, Cincinnati, Ohio.

Karlen, D.L., Stott, D.E. 1994. A framework for evaluating physical and chemical indicators of soil quality. In: Doran, J.W., Coleman, D.C., Bezdicek, D.F., Stewart, B.A. (Eds.), Defining Soil Quality for a Sustainable Environment. 1st ed. SSSA Special Pub. 35, Soil. Sci. Soc. Am., Madison, WI.

Leibig, M.A., Varvel, D., Doran, J.W. 2001. A simple performance-based index for assessing multiple agroecosystem functions. Agron. J. 93.

Larson, W.E., Pierce, F.J. 1994. The dynamics of soil quality and as a measure of sustainable management. In: Doran, J.W., Coleman, D.C., Bezdieck, D.F., Stewart, B.A. (Eds.), Defining Soil Quality for a Sustainable Environment, 1st ed. SSSA Special Pub. 35, Soil Sci. Soc. A., Madison, WI.

ASSESSMENT METHODS: Written exam, Quiz

ENM.541 - **Quantitative Analysis of Mediterranean Ecosystems** (3 ECTS)

LECTURER: Prof. E. Feoli

TYPE OF COURSE AND TEACHING METHODS: Lectures, Field-work, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Development of expertise on vegetation-ecological monitoring for conservation and management purposes.

PREREQUISITES: Knowledge and skills on Spatial Statistics, Basic Geodesy & Digital Photogrammetry, GIS, and Remote Sensing.

COURSE CONTENTS

Place of ecological studies in the plans of Mediterranean land management and development. Ecological perception levels for the vegetation-environment relationship. Ecosystematic approximation. The notion of ecological groups-indicators. Ecological profiles. Information theory. Mapping of Mediterranean terrestrial ecosystems (ecological mapping) for land-use planning. Site evaluation, typology and productivity. Dynamics of ecosystems. Problems of desertification. Field trip: The description of vegetation in the field. The nature and properties of vegetation data, Phytosociology and the Zurich-Montpellier School. Numerical classification and phytosociology. Application of ordination and classification techniques on the same set of vegetation data. Vegetation

mapping as a basis for nature conservation and rational management. Vegetation-ecological monitoring for conservation and management purposes.

RECOMMENDED READING

Kent, M., and P. Coker. Vegetation Description and Analysis – A Practical Approach. CRC Press.

Hagris, C.D., Bissonette, J.A. and L. David. 1998. The Behaviour of Landscape Metrics Commonly Used in the Study of Habitat Fragmentation. Landscape Ecology 13: 167-186. Kluwer Academic Publishers.

Heinrich Walter. Vegetation of the Earth and Ecological Systems of the Geo-biosphere. Second Edition., translated from the third revised German Edition by Joy Wieser. Heidelberg Science Library. Springer-Verlag.

Brecevic, D., Dragan, M., Feoli,E. and Souyong Y. 2004. Migration Towards the Cities: Measuring the Effects of Urban Expansion in Rural-Urban Interface by GIS and RS Technology. In D. Werner (ed.) "Biological Resources and Migration", pp 281-296, Springer , Berlin

Napolitano R., Duriavig M., Altobelli A. and Feoli E., 2004. Data Integration

for Leaf Area Index Prediction in Function of Land Cover Change. In: "e-Environment: Progress and Challenge." Eds. P.Prastacos, U. Cortés, J. L. Díaz de León and M. Murillo. Series Research on Computing Science Volume 11. Published by Instituto Politécnico Nacional, México D.F., México, ISBN:970-36- 0215-0.

Feoli, E., Ganis, P., Ortolan, I., Sitoni, D. and Zerihun, W. 2003. Measuring the effects of human impact on vegetation by integrating phytosociology and remote sensing in a fuzzy set approach. Journal of Vegetation Science 14: 751-760.

Dragan, M. Feoli, E., Fernetti, M. and Zerihun Woldu. 2003. Application of a Spatial Decision Support System (SDSS) to reduce Soil Erosion in Northern Ethiopia. Environmental Modelling and Software Vol, 18, Issue 10 pp 861-868..

Biondi, E., Feoli, E and Zuccarello V. 2004. Modelling Environmental Responses of Plant Associations: A Review of Some Critical Concepts in Vegetation Study. Critical Review in Plant Sciences 23:149-156.

Feoli, E., Giacomich, P., Mignozzi, K., Ozturk, M. and Scimone, M. 2003. Monitoring desertification risk with an index integrating climatic and remotely-sensed data: An example from the coastal area of Turkey. Management of Environmental Quality: An International Journal 14: 10-21.

Feoli, E. 2002. Industrial Ecology and Bioremediation. Theoretical framework and technological tools for sustainable development. In A.G. Fabbri et al. (eds) Deposit and Geoenvironmantal Models for Resource Exploitation and Environmental security pp 291-302. Kluwer Academic Publisher.

Feoli, E., Gallizia-Vuerich, L., Woldu Z.. 2002. Evaluation of the environmental degradation in northern Ethiopia using GIS to integrate vegetation, geomorphological, erosion and socio-economic factors. Agriculture, Environment and Ecosystem, 91: 313-325.

Altobelli, A. Feoli, E., Ourabia, L., 2001. An overview of landscape structure through the application of fractal dimension to remotely sensed images using GIS technology. In Nienartowicz A. and Kunz M: (eds.) GIS and Remote Sensing in Studies of landscape Structure and Functioning. Torun: "in-Druk" s.c. Z. Preisner, I. Poczwardowska (Poland). pp. 39-50.

Gallizia Vuerich L., Poldini L., Feoli E. 2001. Model for the potential natural vegetation mapping of Friuli-Venezia Giulia (Ne Italy) and its application for a biogeographic classification of the region. Plant Biosystems 135 (3): 319-336.

ASSESSMENT METHODS: Project Presentation

ENM.542 - **Landscape Ecology and Environmental Modelling** (3 ECTS)

LECTURER: Prof. J. Kolejka

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Familiarization with principles and rules related to the construction of digital landscape model (DLM) as a basic working tool in modern landscape ecology and application of DLM in landscape planning, risk assessment and presentation of results in 2D, 3D and 4D.

PREREQUISITES: Advanced knowledge and skills on Spatial Statistics, Basic Geodesy & Digital Photogrammetry, GIS, and Remote Sensing.

COURSE CONTENTS

Landscape ecology is able to provide GIS technology with logically integrated data necessary for various documentation, inventory, evaluation and modelling purposes. At the present, the most geospatial landscape data is stored in different format, scale, resolution, projection and cartographic design according to common practice used in thematic mapping. Landscape models and modelling processes need geodata in an integrated form, both geometrically and logically (from thematic viewpoint) to reduce level of errors in consequent data processing. The problem is being progressively solved by the digital landscape model construction and utilizing.

During the course, students will receive general information about landscape models (classification of geospatial models) necessary for landscape evaluation and modelling (verbal, numerical, iconic models). As example of a new logical integrated geospatial database, the digital landscape model (DLM) will be presented. It consists of three multiparameter layers and DEM. Principles of construction and utilizing will be taught. Various applications of DLM will be presented (reforestation, erosion risk assessment, land use pattern optimizing, etc.).

Practical part of course will be focused on practical construction of DLM on local example and its application in 2D and 3D (animated) viewing, as well as in erosion risk evaluation, landscape suitability assessment, and agricultural optimizing measures modelling.

RECOMMENDED READING

Kolejka, J., Plsek, V. and J. Pokorny. 3rd International Symposium on Digital Earth – Information Resources for Global Sustainability. Brno, Czech Republic, September 21-25, 2003

Kolejka J, 2002. Role of GIS in Lifting the Cloud off Chernobyl. Kluwer Academic Publishers.

Kolejka, J, 2004. Multidimensional Digital Modelling in Present Czech Geography. In: Drbolhlav, D., Kalvoda, J., Vozenilek, V. (eds.): Czech Geography at the Dawn of the Millenium. Olomouc, Palacky University in Olomouc, ISBN 80-244-0858-9.

ASSESSMENT METHODS: Project Presentation, Cluster presentation

ENM.543 - **Decision Support Using GIS** (3 ECTS)

LECTURER: Dr. M. Dragan

TYPE OF COURSE AND TEACHING METHODS: Lectures, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Specialisation on techniques used to develop spatial decision support systems (SDSS).

PREREQUISITES: Advanced knowledge and skills on Statistics, Spatial Statistics, Basic Geodesy & Digital Photogrammetry, GIS, and Remote Sensing.

COURSE CONTENTS

The course will present the techniques to integrate databases, remote sensing and GIS to develop spatial decision support systems (SDSS) for the sustainable use of environmental resources (natural and artificial). Sustainability means that the use and conservation of biodiversity, soil and water should not represent conflicting activities but complementary objectives to be jointly achieved in management practices.

The course will present:

- a summary of GIS technology with particular emphasis to the map object oriented approach
- the idea of Knowledge databases based on fuzzy set theory,
- the concepts of Decision making,
- an introduction to Multicriteria Decision Analysis,
- the notion of Spatial Decision Support System with applications for optimal sitting.

The course will be articulated in lectures and demonstration of case studies using Arcview GIS and IDRISI.

RECOMMENDED READING

T.L. Saaty. 2000. Decision Making for Leaders – The Analytic Hierarchy Process for Decisions in a Complex World. University of Pittsburg. RWS Publications. ISBN 0-9620317-8-X.

Chen, K., Blong, R., and C. Jacobson. 2001. MCE-RISK: Integrating Multicriteria Evaluation and GIS for Risk Decision-Making in Natural Hazards. Environmental Modelling & Software. Elsevier Science Ltd.

ASSESSMENT METHODS: Project Presentation

ENM.551 - **Spatial Planning and Environmental Assessment** (3 ECTS)

LECTURER: Prof. G. Carsjens

TYPE OF COURSE AND TEACHING METHODS: Lectures, Practical group assignments, idividual essays, Case Studies, Computer-aided teaching

OBJECTIVE OF THE COURSE: Advanced knowledge about the process and basic elements of Environmental Impact Assessment and Strategic Environmental Assessment, and skills towards the use of methods and tools for environmental impact identification, prediction and evaluation, with special emphasis on qualitative methods and tools.
PREREQUISITES: Advanced knowledge and skills on Statistics, Spatial Statistics, Basic Geodesy & Digital Photogrammetry, GIS, and Remote Sensing

COURSE CONTENTS

The course includes three different parts, each addressing specific theory, methods and tools for environmental assessment, with special emphasis on issues and case studies related to spatial planning of urbanized areas. The background and the assignments are introduced and explained in a written course manual.

In the first part the principles and the process of Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) will presented in an introduction lecture. Some selected chapters of books will be studied and specific methods and tools, especially for scoping and evaluation, will be dealt with in practical assignments. The assignments include the use of matrices, multicriteria techniques and GAM (goals achievement matrix).

The second part of the course focuses at the use of environmental standards and zoning, with examples from case studies in Europe. Also area-based approaches are introduced, such as the environmental matrix. The methodological strengths and weaknesses of these, and other methods will be discussed, and the potential applicability of these methods within the context of environmental planning in other countries.

The third part of the course focuses on a specific case study. The students will examine the study area with the ArcView DSS-tool STEPP (Strategic Tool for integrating Environmental aspects into Planning Processes). The objective is to identify the most important issues and impacts in the area (i.e. scoping) and describe its present environmental quality. For a selected smaller area an environmental advice for the local authorities should be written for the future urban development of the area, including residential and/or industrial areas. Several spatial scenarios (alternatives) should be presented, together with an assessment of the environmental consequences of each alternative with STEPP. It should be made clear what the different options are the local authorities have with regard to the future development of the selected area from environmental point of view. The results will be described in a short report with maps.

RECOMMENDED READING

Glasson, J., R. Therivel, and A. Chadwick, 2003. Introduction to environmental impact assessment: Principles and procedures, process, practice and prospects, 2nd Edition. Spon Press, London.

Schmidt, M., E. João, and E. Albrecht (Eds.), 2004. Implementing strategic environmental assessment, Environmental protection in the European Union, Volume 2.

Carsjens, G.J., R.J.A. van Lammeren & A. Ligtenberg, 2002. STEPP: Strategic Tools for integrating Environmental aspects into Planning Procedures. In: S. Geertman & J. Stillwell (Eds.), Planning support systems in practice, Springer-Verlag, Berlin.

ASSESSMENT METHODS: Project Presentation

ENM.552 - **Environmental Legislation** (3 ECTS)

LECTURER: Prof. M. Kouskouna

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Demonstration of the valid EU legislative framework on environmental issues.

PREREQUISITES:

COURSE CONTENTS

Historical background:

The relevance for international environmental law of the developments in the EU:

- Adoption of the main principles concerning environmental protection at a regional regime level.
- EU system's mechanism of implementing and executing its legal rules: sources, institutions and treaty modifications concerning European environmental policy (adoption of sustainable development theory).

The objectives and principles of EU environmental law:

- The integration principle and its impact on other European policies, especially the exclusive ones.
- The precautionary (preventive action) principle and the EU legislation on environmental matters.
- Rectification at source and mechanism of remedies in the EU legal order.

Implementation and enforcement of environmental law in the national legal orders:

- Supremacy, direct effect, implied powers doctrine.
- The decision-making process based on qualified majority.
- The preference for directives and the particular problems caused by their application in the member states.
- The individual (persons and companies) as direct addressee of European legal rules.
- The role of the European Court of Justice in environmental matters.

Environmental impact assessment: a technique for implementing international and European environmental rules:

- The integration of environmental considerations into socio-economic development and decision-making process in view of satisfying the preventive principle.
- Directive 85/337/EEC (as amended).
- The meaning of significant effect on the environment and the extension of the lists of projects by Directive 97/11/EC.
- The problems of interpretation of the directives and the relevant Commission reports practical analysis.
- Legal problems concerning the EIA of a project to be adopted (short reference to national and European jurisprudence).

RECOMMENDED READING

L. Kramer, EC Environmental Law, 5th edition, Sweet & Maxwell, 2003.

J. Jans, European Environmental Law, Europa Publishing 2000.

Ph. Stands, Principles of International Environmental Law, Cambridge University Press, 2003.

Leading cases of the European Court of Justice environmental protection issues in the European Union.

ASSESSMENT METHODS: Written exam

ENM.553 - **Environmental & Natural Resource Economics** (3 ECTS)

LECTURER: Prof. M. Shelby

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Basic conceptual grounding for economic assessment of environmental issues.

PREREQUISITES:

COURSE CONTENTS

This course is founded on the conviction that economic reasoning has much to offer (though it is not a panacea) in addressing these challenges. The course is designed to provide the basic conceptual grounding for the use of economics to inform decisions regarding the proper use of the environment and natural resources. Beginning with the concept of "sustainability", the course develops a framework for an economic assessment of environmental problems including the notion of market failures, valuation of environmental resources and policy design issues associated with using alternative economic incentives and instruments. The last part of the course examines principles of the economically efficient management of non-depletable and depletable (i.e., fossil fuels) resources. A number of applied settings are used to demonstrate the principles taught in the course.

RECOMMENDED READING

T. Tietenberg. Environmental and Natural Resource Economics. Sixth edition.

D. Pearce and R.K. Turner. Economics of Natural Resources and the Environment.

ASSESSMENT METHODS: Written exam

ACADEMIC SUPPORT FACILITIES

Laboratory of Geographic Information Systems and Remote Sensing

Computing resources play an important role in the Environmental Management course. An extensive range of hardware and software is available to support formal teaching, which covers Information Technology, Geographical Information Systems, Remote Sensing, Spatial Statistics and Decision Support, as well as research requirements in postgraduate (MSc theses) or academic level.

Facilities include a dedicated teaching laboratory equipped with regularly updated high specification computing hardware and software. Windows XP/2000 networks of PC compatible computers are used and backups are regularly kept. Facilities also include the Automated Cartography Unit (ACU), the Field Survey Unit, the Natural Object Hyperspectral Identification Unit and the Forest Fire Wind Tunnel Simulator.

ArcGIS (ArcInfo, ArcView), ERDAS Imagine, ENVI, eCognition, GRASS and IDRISI packages are widely available within the Department together with an extensive range of generic proprietary and academic PC packages. The system is supported by Computer Technicians who are responsible for day–to–day management of the facilities. A range of software manuals, practical handbooks, cookbooks and field guides, is available in the GIS laboratory. These facilities provide excellent opportunities for postgraduate students to develop 'hands on' skills in Remote Sensing and geographical information technology and analysis.

Automated Cartography Unit

ACU is dedicated to capturing (digitizers and scanners), processing, integration, archiving and printing (printers and plotters) of imaging and non–imaging datasets. The Unit's equipment includes:

1 A0 Scanner, 1 A3 Scanner, 1 A0 Digitizer, 1 A3 Digitizer, 1 A0 HP Plotter, 1 Desk Trimmer, 1 A3 HP cp 1700 colour inject printer, and 1 HP 2100 laser printer.

Field Survey Unit

The Field Survey Unit is dedicated to support fieldwork and field campaigns with all the necessary equipment and tools. The Unit comprises the following:

Differential GPS (single frequency) with sub-meter accuracy, Handheld Hyperspectral Radiometer, Range Finder (Laser Hypsometer), Bark diameter (DBH), Compass, Video camera, Digital camera, Laptop and Pocket PC equipped with embedded GPS receiver and ArcPad.

Natural Objects Multispectral Identification Unit

The Natural Object Hyperspectral Identification Unit is dedicated to studying and spectrally characterising materials, such as plants or parts of them, rocks and chemicals in laboratory conditions according to established spectral libraries. The Unit is equipped with the following:

Hyperspectral Radiometer (range 450-1050 nm), Dark Chamber, Special Lamp, White Reference, Tripod and accessories.

Forest Fire Wind Tunnel Simulator Unit

The wind tunnel facility of MAICh was built in 1999 and is used in different research projects related to forest fires. It meets all the international specifications for simulated fire and wind experiments. The tunnel's dimensions are: 10.3m length, 1.8m height and 1.6m width. The wind speed is adjustable at a range of 0.0-2.5m/sec by two ventilators (60cm diameter each) that regulate laminar air flow through suction. The wind tunnel was constructed with fire proof materials and it is equipped with a data acquisition system with thermocouples connected to a computer, digital hotwire anemometer, digital video camera, hydrometers, thermometers etc.

MASTERS OF SCIENCE PROGRAM

Research Project (9 month duration)

Requirement

60 ECTS credits. Laboratory techniques (Related to the subject of the Master Thesis)

Research Subject Areas (topics generally available for Master of Science thesis)**:**

- Desertification Monitoring,
- Environmental Resource Management,
- Environmental Impact Assessment,
- Landscape Ecology,
- Soil Erosion Risk Assessment,
- Agricultural Practices Monitoring,
- Precision Agriculture,
- Forest Fire Risk Assessment
- Fire Behaviour Modelling & Effectiveness of Fire Retardants,
- Management of Mediterranean Ecosystems, and
- Regional and Rural Development

Indicative master thesis realized within the area

TITLE: A GIS Developed for Risk Assessment of Stream Pollution Caused by Olive Oil Factories in Kolymvari, Crete.
AUTHOR: Ioannis Sarakiotis, Environmentalist, Greece
PLACE OF REALIZATION: MAICH
THESIS DIRECTOR(S): Prof. G. Zalidis, Mr. C. Karydas

TITLE: Risk Assessment of Soil Erosion Using Rusle Model in the Olive Cultivation Area of Kolymvari, Crete
AUTHOR: Tijana Sekuloska, Agronomist, FYROM
PLACE OF REALIZATION: MAICH
THESIS DIRECTOR(S): Prof. N. Silleos, Mr. C. Karydas

TITLE: Mapping of Afromontane Forests and Vegetation of Bioko Island (Equatorial Guinea) Using LANDSAT ETM + data
AUTHOR: Nicholas Alexander Kasimis,, B.A. Philosophy, USA/Greece
PLACE OF REALIZATION: University of Cordoba, Spain
THESIS DIRECTOR(S): Dr. Rafael navarro, Dr. Margarita Clemente

TITLE: The Development of an Object-oriented Classification Model for Burned Area Mapping Using ASTER imagery
AUTHOR: Anastasia Polychronaki, Forester, Greece
PLACE OF REALIZATION: Aristotle University/ MAICh
THESIS DIRECTOR(S): Dr. I. Gitas

TITLE: The Application of a Quantitative Analysis and a Decision Support System for Spatial Development in Central Costa Rica
AUTHOR: Georgiana Manole,, Economist, Romania
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Prof. E. Feoli

TITLE: Foundation and Automatisation of Novel Pre-moisaicing Spectral Adjustment Technique Through ERDAS IMAGINE Software's Capabilities
AUTHOR: Stefana Popova, Landscape Architect, Bulgaria
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Dr. I. Gitas

TITLE: Soil Properties Mapping Using Spatial Interpolation Techniques
AUTHOR: Irene Koutsogiannaki, Oceanographer, Greece
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Dr. I. Gitas and Prof. N. Silleos

TITLE: Identifying and Inventorying Demographical Patterns, Integrating Census and Remotely Sensing Data. A Case Study: The City of Tirana in Albania
AUTHOR: Michalis Agorastakis, Planning and Urban Development Engineer, Greece
PLACE OF REALIZATION: University of Thessaly / MAICh
THESIS DIRECTOR(S): Prof. B. Kotzamanis and Invited Prof. M. N. Duquenne

TITLE: Vegetation Changes and Desertification Processes in Chott El Beida Algeria . An Approach Based on Remote Sensing Techniques and Multivariate Analysis.
AUTHOR: Mouna Khaznadar, Forester, Algeria
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Prof. G.H. Griffiths and Dr. I.N. Vogiatzakis

TITLE: Industrial sites assessment and land suitability identification for industrial development in Riuli Venezia Giulia (Italy) by GIS and Remote Sensing techniques.
AUTHOR: Jawad Youssef, Forester, Syria
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Prof. E. Feoli

TITLE: U se of radar for in-burned area mapping.
AUTHOR: Azniv Petrosyan, Computer Systems & Informatics Engineer , Armenia
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Dr. I. Gitas

TITLE: Mapping of the quarries areas and monitoring their expansions on the Mediterranean island of Thasos over the period of fifteen years using LANDSAT data.
AUTHOR: JaneHilal, Chemist, Palestine
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Dr. I. Gitas

TITLE: Geology survey of the Aegean islands.
AUTHOR: Eirini Papadaki, Geologist, Greece
PLACE OF REALIZATION: University of the Aegean , Mytilini , Greece
THESIS DIRECTOR(S): Prof. N. Sulakelis

TITLE: Development of an object-oriented model for mapping and differentiating rangeland types in western Crete using IKONOS imagery
AUTHOR: Crina Belean, Ecologist, Romania
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Prof. V. Papanastasis and Dr. I. Gitas

TITLE: Impact of piospheric points on Mediterranean rangelands
AUTHOR: Rodolphe Ghossoub, Agriculturalist , Lebanon

PLACE OF REALIZATION: Aristotle University of Thessaloniki , Greece
THESIS DIRECTOR(S): Prof. V. Papanastasis

TITLE: Impact mapping of distribution of exotic plant species on the Akrotiri Peninsula (Crete , Greece)
AUTHOR: Graham Loewenthal, Earth Science Engineer , United Kingdom
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Dr. P. Hulme and Dr. I. Gitas

TITLE: The development of an object-oriented classification model for burned area mapping on the Mediterranean island of Thasos using LANDSAT TM Imagery
AUTHOR: George Mitri, Environmentalist, Lebanon
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Dr. I. Gitas

TITLE: Cooperation of Remote Sensing and GIS in Water Management and Land Use Planning in El-Hamam Area, Northern Coast of Egypt
AUTHOR: Mahmoud Ali Gaber Mohamed, Agriculturalist , Egypt
PLACE OF REALIZATION: Cairo University – Fayoum Branch , Egypt
THESIS DIRECTOR(S): Dr. F. Attia and Dr. M. Shendi

TITLE: Change detection in Chania region (Crete , Greece) using a time series of normalized remotely sensed data
AUTHOR: Ouerdia Hadjarab, Forester, Algeria
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Prof. N. Silleos and Dr. I. Gitas

TITLE: Integrated Use of Geographic Information Systems and Remote Sensing for Landscape Analysis in Fiuli-Venezia Giulia, Italy
AUTHOR: Rachid Rekouane, Geotechnologist , Algeria
PLACE OF REALIZATION: University of Trieste , Italy
THESIS DIRECTOR(S): Prof. E. Feoli

TITLE: Burned Area and Fire Severity Mapping on yhe Mediterranean Island of Thasos Using LANDSAT TM and IKONOS Images
AUTHOR: Rishmawi Khaldoun, Biologist, Palestine
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Dr. I. Gitas

TITLE: Postfire fuel and vegetation dynamics in phryganics in an ungrazed phryganic community of Crete (Greece)
AUTHOR: Farid Belbahir, Agronomist, Algeria
PLACE OF REALIZATION: MAICH
THESIS DIRECTOR(S): Dr. A. Dimitrakopoulos

TITLE: The use of satellite data for the derivation of a desertification risk index for the Lebanon , and for desertification monitoring in the Bekaa Valley
AUTHOR: Talar Sahsuvaroglou, Health Environmentalist, Turkey
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Dr. I. Gitas

TITLE: Computer Assisted Discrimination of Homogeneous Morpho-Units on the Basis of the Application of Multivariate Statistical Methods to Local Gradients Setting of Crete Island
AUTHOR: Ayodele Oluwatomi Adediran, Geographer, Nigeria

PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Dr. I. Parcharidis and Dr. M. Poscolieri

TITLE: The ecology and management of Merja Zerga wetland in western Morocco
AUTHOR: Fouad Telmani, Forester, Morocco
PLACE OF REALIZATION: MAICh
THESIS DIRECTOR(S): Prof. N. Papageorgiou

References of the main academic staff teaching within the M.Sc.

More than 50 invited lecturers from about 12 countries participate in each edition of the M.Sc. programme of which, 46% came from Research Centres, 42% from Higher Education Institutions, 7% from Private Companies and 5% from International Centres. Considering their implication in the programme, the following academic staff is taken as reference:

CZECH REPUBLIC
Higher Education Institutions
- Jaromir KOLEJKA, Mendel University of Agriculture and Forestry in Brno, Czech Republic

GERMANY
Research Centres
- Steffen KUNTZ, Infoterra GmbH, Friedrichshafen, Germany

GREECE
Higher Education Institutions
- Vasilios PAPANASTASIS, Aristotle Univ., Thessaloniki, Greece
- Ioannis ISPIKOUDIS, Aristotle Univ., Thessaloniki, Greece
- Alexandros DIMITRAKOPOULOS, Aristotle Univ., Thessaloniki, Greece
- Nicholaos SILLEOS, Aristotle Univ., Thessaloniki, Greece
- George ZALIDIS, Aristotle Univ., Thessaloniki, Greece
- Kostantinos VOUVALIDES, Aristotle Univ., Thessaloniki, Greece
- Ioannis GITAS, Aristotle Univ., Thessaloniki, Greece
- Thomas ALEXANDRIDES, Aristotle Univ., Thessaloniki, Greece
- Konstantinos PERAKIS, Univ. of Thessalia, Volos, Greece
- Nikolaos SOULAKELIS, Univ. of Aegean, Mytilini, Greece
- Ioannis HATZOPOULOS, Univ. of Aegean, Mytilini, Greece
- Metaxia-Lina KOUSKOUNA, Univ. of Athens, Greece
- Gerassimos ARAPIS, Agricultural Univ. of Athens
- Vasilios TSIOUKAS, Democritus Univ. of Thrace
- Periklis DRAKOS, Univ. of Crete, Rethymnon, Crete, Greece
- Athanasios MIGDALAS, Technical Univ. of Crete, Chania, Greece
- George MARKAKIS, Technical Educ. Inst. of Heraklion, Crete, Greece
- Athanasios GERTSIS, American Farm School of Thessaloniki, Greece
- Ioannis MANAKOS, Mediterranean Agronomic Institute of Chania, Greece
- Efthimios AVGERINOS, Mediterranean Agronomic Institute of Chania, Greece

- Christos KARYDAS, Mediterranean Agronomic Institute of Chania, Greece

Research Centres

- Kaliopi RADOGLOU, Institute of Forest Research, Thessaloniki, Greece

ITALY

Higher Education Institutions

- Enrico FEOLI, University of Trieste, Italy
- Masimo DRAGAN, University of Trieste, Italy
- Andrea CAMIA, University of Torino, Italy

Research Centres

- Jesus SAN-MIGUEL-AYANZ, European Commission – DG Joint Research Centre, Ispra, Italy
- Paulo BARBOSA, European Commission – DG Joint Research Centre, Ispra, Italy

NETHERLANDS

Higher Education Institutions

- Gerrit CARSJENS, Wageningen Univ. The Netherlands

Research Centres

- Norman KERLE, International Institute for Geoinformation Science and Earth Observation (ITC), Enschede, The Netherlands

UNITED KINGDOM

Higher Education Institutions

- Seraphim ALVANIDES, Univ. of Newcastle, U.K.
- Dimitris BALLAS, Univ. of Sheffield, U.K.
- Mike KIRKBY, Univ. of Leeds, U.K.
- Gabriel AMABLE, Univ. of Cambridge, U.K.
- Stephen MACKIN, University of Surrey, U.K.

UNITED STATES

Higher Education Institutions

- Andy MAVROMOUSTAKOS, Univ. of Arcansas, USA

Research Centres

- Michael SHELBY, U.S. Environmental Protection Agency, Washington DC, USA

Horticultural Genetics and Biotechnology

Postgraduate Specialisation and M.Sc. Programme

SCIENTIFIC COORDINATOR: **Dr. Panagiotis Kalaitzis**

EDUCATIONAL AND PROFESSIONAL GOALS

The long course on Horticultural Genetics & Biotechnology provides a two-year Master of Science degree programme for scientists holding a university Bachelors degree in agronomy, biology, horticulture, agricultural engineering, chemistry, plant science or any related field. The major goals of the Department of Horticultural Genetics and Biotechnology are to provide the students with a thorough grounding in the mechanisms, capabilities, uses and limitations of plant biotechnological methods so that they will be able to apply them to problems related to horticultural production and quality.

The first year students receive a solid theoretical background and practical training, leading to the attainment of a PGD certificate, attending classes and extensive laboratory courses in the following fields: (i)Applied plant molecular genetics and biotechnology including the hormonal and developmental regulation of gene expression, in vitro and tissue culture techniques, and transformation strategies; (ii) Applied plant genetics including marker-assisted breeding, risk assessment for Genetically Modified Organisms, Genetically Modified Organism certification protocols and Arabidopsis genetics. Emphasis throughout the course is placed on horticultural crops and their products.

In the second year, students who have successfully completed the first year will develop advanced molecular biology technical skills and independent thinking by working on research projects in modern, well-equipped laboratories leading to a Master's of Science degree.

ACCESS TO FURTHER STUDIES

Statistics show that 28% of M.Sc. graduate students are accepted to Ph.D. programmes with full scholarship in European and North American Universities.

POST GRADUATE SPECIALISATION PROGRAMME

The programme is organized in 5 sections

Section I - Introductiory Discipline

The Cycle includes introductory courses on Scientific English and use of Computer.

Section II - Introduction to Advanced Biology

The Cycle is dedicated to bioscience core courses. The scope of this module is to strengthen the students' training in the fundamental and time-independent aspects of sciences upon which all subsequent and ever-evolving specialization will rest.

Section III - In-Vitro Production Techniques

The Cycle deals with advanced propagation techniques. It focuses on in-vitro techniques for plant propagation and also includes a week of hands-on laboratory training.

Section IV - Applied Genetics

The Cycle is devoted to applied genetics. The first week teaches the basic principles of genetics followed by the concepts of molecular breeding and how they may be applied to improve crop production and quality. One week's practical training on molecular breeding techniques will improve understanding of these advanced methods. The second part of this module is dedicated to Arabidopsis thaliana, the model system for plant genetics, and will cover mutant analysis and transformation protocols.

Section V - Post-Harvest Biotechnology

This Cycle provides an overview of the recent advances on post-harvest biotechnology. One week on the physiology and the biochemistry of plant senescence will up-date students on the basic principles of this area. This course inter-relates with one week of classes on the regulatory role of ethylene in ripening and senescence process, followed by recent developments in the molecular biology of fruit ripening. Finally, one week of practical training on advanced techniques in biotechnology will provide students with the tools to better understand and exploit this field of research. The remaining courses deal with the issue of Genetically-Modified agricultural products and the ecological risk assessment of producing such crops followed by the laboratory on how to certify GMO agro-products.

TRAINING SEQUENCE

Section I - Introductiory Discipline [7 ECTS]
October to November

HOB.501 - Scientific English (3 ECTS)

HOB.502 - Introductory Computing (1 ECTS)

Section II - Introduction to Advanced Biology [18 ECTS]
from November to December

HOB.511 - Cell Biology (3 ECTS)

NPB.512 - Biochemistry (3 ECTS)

HOB.513 - Stress Physiology (3 ECTS)

HOB.514 - Genetics (3 ECTS)

HOB.515 - Molecular Biology (3 ECTS)

HOB.516 - Molecular Biology Technology (Lab) (3 ECTS)

Section III - In-Vitro Production Techniques [6 ECTS]
from January to February

HOB.521 - In-Vitro Techniques for Applied Biotechnology (3 ECTS)

HOB.522 - Tissue Culture and In-Vitro Techniques (Lab) (3 ECTS)

Section IV - Applied Genetics [18 ECTS]
from February to March

HOB.531 - Molecular Breeding of Horticultural Crops (3 ECTS)

HOB.532 - Genetic Improvement and Seed Production (3 ECTS)

HOB.533 - DNA Fingerprinting Technology (3 ECTS)

HOB.534 - Arabidopsis Genetics (3 ECTS)

HOB.535 - Mutant Analysis of Arabidopsis (3 ECTS)

HOB.536 - Arabidopsis Transformation & Analysis of Transgenic Plants (3 ECTS)

Section V - Post-Harvest Biotechnology [21 ECTS]
from March to June

HOB.541 - Molecular Biology and Biochemistry of Fruit Ripening (3 ECTS)
HOB.542 - Biotechnology of the Plant Hormone Ethylene (3 ECTS)
HOB.543 - Nutritional Genomics (3 ECTS)
HOB.544 - CA Storage and Molecular Basis of Hypoxia (3 ECTS)
HOB.545 – Advanced GMO Detection Methodologies (Lab) (3 ECTS)
HOB.546 - Environmental Risk Assessment of GMOs (3 ECTS)

ANALYTICAL SYLLABUS

HOB.501 - **Scientific English** (3 ECTS)

LECTURER: M. Verivaki

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: The development of scientific writing and communication skills.

PREREQUISITES: Good knowledge of English language.

COURSE CONTENTS
A review of the fundamentals of English grammar. Oral communication, public speaking and note-taking. Development of academic writing skills, study of scientific text and papers.

RECOMMENDED READING
Papers provided by the instructor.

ASSESSMENT METHODS: Written exam

HOB.502 - **Introductory Computing** (1 ECTS)

LECTURER: N. Boretos

TYPE OF COURSE AND TEACHING METHODS: Computer-assisted teaching

OBJECTIVE OF THE COURSE: Introduce scientists to the computer-based resources available.

COURSE CONTENTS
Introduction to computer utilization

RECOMMENDED READING
European Computing Driving Licence.

ASSESSMENT METHODS: Written exam

HOB.511 - **Cell Biology** (3 ECTS)

LECTURER: Prof. K. Vlachonasios

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To introduce students to the fundamentals of plant cell biology. To strengthen their background on biological mechanisms that takes place in the eukaryotic and prokaryotic cell. Students understand the complexity of cells and the environment where fundamental processes preserve cell homeostasis.

COURSE CONTENTS

Eukaryotic versus prokaryotic cells. Cell structure and compartmentation. Cell membranes and their principles. Cell organelles and their principles. Cell organelles and their physiology. Intracellular and intercellular communication. Genetic information storage – nucleus. Nuclear cytoplasmic interactions. Cell specialization – animal and plant cells. Cell responses to environmental stimuli.

RECOMMENDED READING

Biochemistry & Molecular Biology of Plants, B. Buchanan, W. Gruissem, R. Jones, eds. 2000, American Society of Plant Physiologist.

ASSESSMENT METHODS: Written exam

NPB.512 - **Biochemistry** (3 ECTS)

LECTURER: Prof. K. Seceris

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To familiarize with all the important components of the chemistry of life. To introduce students to the structure and function of proteins and nucleic acids.

COURSE CONTENTS

Water, solvent of life; Properties of solutions; buffers. Biological macromolecules; (proteins, nucleic acids, polysaccharides, lipids)

Proteins: Levels of protein organization, Protein interactions Cell environment factors controlling protein assembly, Protein synthesis

Post-translation modifications, Protein compartmentation, Protein stability and turnover, Multiple functional stages of proteins, Multiplicity of protein forms and functions, Plant and insect hormones and their receptors

Polysacharides: Cell surface diversification, Cell adhesion, Natural products

Lipids: Simple and complex lipids, Lipoproteins, Lipid messengers, Nucleic acids.

RECOMMENDED READING

Lehninger: Chapter 3 (Biomolecules), Ch. 4 (Water), Ch. 5 (Aminoacids and peptides), Ch. 6 (An introduction to proteins), Ch. 7 (The three dimensional structure of proteins), Ch. 9 (Lipids), Ch. 11 (Carbohydrates), Ch. 12 (Nucleotides and nucleic acids) and Ch. 26 (Protein Metabolism

ASSESSMENT METHODS: Written exam

HOB.513 - **Stress Physiology** (3 ECTS)

LECTURER: Dr. T. Awada

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide an overview of plant stress and environmental physiology. To strengthen the background on basic physiological mechanisms that plants employ to overcome adverse conditions.

COURSE CONTENTS

Selected topics on environmental physiology: Water relationships (the soil-plant atmosphere continuum, water transport processes, the anatomy of the pathway, stomatal control and transpiration). Photosynthesis, physiological and ecological. Considerations (Photosynthetic responses to light, to CO2 and to temperature). Biological nitrogen fixation.

Selected topics on stress physiology: An overview of resistance mechanisms of plant responses to stresses. Recognition and signal transduction. Stress-induced gene expression. Oxidative stress, a

constituent of all stresses. Stresses imposed by water deficits (drought, low and high temperatures, salinity) and by oxygen deficiencies (flooding).

RECOMMENDED READING

Jones, H.G. Plants and microclimate.1994. Cambridge University press.

Fitter, A.H. and Hay, R.K.M. 2002. Environmental physiology of plants. Academic press.

Taiz, L. and Zeiger E. 1998. Plant Physiology. Sinauer Associates Inc., Publ.

Larcher, W. 2003. Physiological Plant Ecology. Springer.

Lambers et al. 2000. Plant Physiological Ecology. Springer.

Ajay Arora, R. K. Sairam and G. C. Srivastava. 2002. Oxidative stress and antioxidative system in plants. Current Sci. 82: 1227-38.

ASSESSMENT METHODS: Written exam

HOB.514 - **Genetics** (3 ECTS)

LECTURER: Prof. A. Tsaftaris

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide an introduction into the science of Genetics, a historical perspective and understanding of the current issues.

COURSE CONTENTS

Historical perspective of Genetics. Early genetic experiments. Experimental derivation of the laws of inheritance/ Mendel.

Critical experiments in the development of Genetics.

Chromosome theory of inheritance. The unit of heredity.The nature of the gene; Cistrons. Position effects of DNA (Mc Clintock's work). Gene synthesis. Genetic engineering. Impact of Genetics on Society.

RECOMMENDED READING

The double Helix-50 years, Nature Publishing Group Supplement (2003) Vol. 421, p 395-453.

RNA-directed DNA methylation, (2000) M. Wassenegger, Plant Molecular Biology, 43: 203-220.

Status of genome projects for nonpathogenic bacteria and archaea, K. E. Nelson, Ian T. Paulsen, J. F. Heidelberg and C. M. Fraser (2000) Nature Biotechnology Vol. 18, 1049-1054.

Functional genomics, Nature insight, Reprinted from Vol. 405, no. 6788, 2000, p 819-822.

The Evolution of Epigenetics (2001), Science, Vol. 293, p 1063-1105.

Epigenetic Mechanisms of Gene Regulation, Edited by Vincenzo E.; A. Russo, Robert A. Martienssen and Arthur D. Riggs, p. 5-24.

Bioinformatics: A Biologist's Guide to Biocomputing and the Internet, Stuart M. Brown, Ch. 2 and Ch. 3.

DNA sequence of both chromosomes of the cholera pathogen Vibrio cholerae, J. F. Heidelberg, J. A. Elsen, W. C. Nelson, R. A. Clayton, M. L. Gwinn, R. J. Dodson, D. H. Haft, E. K. Hickey, J. D. Peterson, L. Umayam, S. R. Gill, K. E. Nelson, T. D. Read, H. Tettelin, D. Richardson, M. D. Ermolaeva, J. Vamathevan, S. Bass, H. Qin, I. Dragoi, P. Sellers, L. McDonald, T. Utterback, R. D. Fleishmann, W. G. Nierman, O. White, S. L Salzberg, H. O. Smith, R. R. Colwell, J. J. Mekalanos, J. Graig Venter and C. M. Fraser (2000), Nature Vol. 406, p. 477-483.

Molecular Cloning, A Laboratory Manual, Joseph Sambrook and David W. Russell.

The Unseen Genome: Gems among the Junk, Scientific American (2003).

The Asteroid Tugboat, R. L. Shweickart, E. T. Lu, P. Hut and C. R. Chapman (2003), Scientific American.

ASSESSMENT METHODS: Written exam

HOB.515 - **Molecular Biology** (3 ECTS)

LECTURER: Dr. D. Kafetzopoulos

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To familiarise with DNA science and provide an understanding of the fundamental molecular processes taking place in a cell. To introduce students to the basic steps in the flow of genetic information.

PREREQUISITES: Basics knowledge of Genetics and Biochemistry.

COURSE CONTENTS

Stereochemistry of DNA and DNA topology. DNA replication, In vitro genetics. Restriction enzymes. Transcription factors. Transcriptional machineries. Pleiotropic effects of transcription. The substrate of transcription (chromatin). Role of introns-exons. Post transcriptional regulation. Post translational regulation. Differential gene expression and chromosomal domains. Extranuclear DNA. Environmental effects of gene expression.

RECOMMENDED READING

Molecular Cell Biology, 5th Ed., Ch. 4, Ch. 9

ASSESSMENT METHODS: Written exam

HOB.516 - **Molecular Biology Technology (Lab)** (3 ECTS)

LECTURER: Dr. P. Kalaitzis

TYPE OF COURSE AND TEACHING METHODS: Laboratory

OBJECTIVE OF THE COURSE: To introduce students to the basic plant molecular biology techniques in the laboratory.

COURSE CONTENTS

Introduction to basic molecular biology techniques. Ligation, Transformation of E.coli, Plasmid DNA isolation, plant RNA and DNA extraction, RT-PCR.

RECOMMENDED READING

Molecular cloning – A Laboratory Manual, Third Edition, Sambrook and Russell, Volumes 1, 2, 3

ASSESSMENT METHODS: Written exam

HOB.521 - **In-Vitro Techniques for Applied Biotechnology** (3 ECTS)

LECTURER: Prof. E. Rugini

TYPE OF COURSE AND TEACHING METHODS:

OBJECTIVE OF THE COURSE: To provide the students with an overview of plant tissue culture techniques and their potential in the production of propagative material

COURSE CONTENTS

Plant tissue culture is the science of growing plant cells, tissues or organs in defined media under sterile and optimized environmental conditions. This course deals with techniques and methods such as callus culture in liquid and solid media, protoplast cultures, and the production of haploid and triploid plants. Particular attention will be given to regeneration strategies, somatic embryogenesis and shoot organogenesis in relation to gene transformation protocols. Finally, prospects for the use of somaclonal variation to develop germplasm with useful traits will be discussed.

RECOMMENDED READING

Plant tissue culture concepts and laboratory exercises, Second edition, Chapter 14, Chapter 43.

Tissue culture techniques for horticultural crops, K.C. Torres, Chapter 18.

ASSESSMENT METHODS: Written exam

HOB.522 - **Tissue Culture and In-Vitro Techniques (Lab)** (3 ECTS)

LECTURER: N. Leventakis, K. Grigoriadou, Ch. Dovas

TYPE OF COURSE AND TEACHING METHODS: Laboratory

OBJECTIVE OF THE COURSE: To provide hands on experience in tissue culture techniques and production of virus-free material

COURSE CONTENTS

This practical training course will concentrate on basic methods used in tissue culture laboratories. These methods include working under aseptic conditions, media preparation from stock chemicals and cultures of meristematic tissues. In addition, students will gain hands-on experience of the detection and diagnosis of plant viruses using ELISA assays and also the methodology required for the production of certified plant material.

RECOMMENDED READING

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam

HOB.531 - **Molecular Breeding of Horticultural Crops** (3 ECTS)

LECTURER: Dr. J. Garcia / Dr. P. Verus

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To introduce students into molecular markers and how they are used in molecular breeding

COURSE CONTENTS

The selection of superior genotypes is often hampered by the significant influence that environmental factors have on the expression of a trait and the variability of these environmental factors. This is especially true for traits related to crop yield. The efficiency of selection for useful traits can be improved when the genes responsible for the traits or genes closely linked to them are known. Many molecular techniques are now available for the identification of such genes. This course will focus on molecular techniques such as AFLP (Amplified Fragment Length Polymorphism), ISSR-PCR (Inter-Specific Simple Repeat PCR), RAPD (Randomly-Amplified Polymorphic DNA) and how they can be used to assess genetic variability in plant germplasm collections or to fingerprint on commercial scale cultivars of horticultural crops.

RECOMMENDED READING

Introduction to quantitative genetics, Third edition, D. S. Falconer, Chapter 10 Heritability.

The genetic architecture of quantitative traits, Trudy F. C. Mackay, Annu. Rev. Genet. 2001.

From plant to genomics to breeding practice, M. Morgante and F. Salamini, Current Opinion in Biotechnology 2003.

Mapping polygenes, S.D. Tanksley, Annu. Rev. Genet. 1993.

QTL analysis in plants; where are we now?, M.J. Kearsey and A.G.L. Farquhar, Heredity (80), 1998.

ASSESSMENT METHODS: Written exam

HOB.532 - **Genetic Improvement and Seed Production** (3 ECTS)

LECTURER: Prof. N. Fanourakis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide basic principles of plant breeding and seed production techniques

COURSE CONTENTS

ntroduction. The purpose of plant breeding. Basic principles of recombination. Reproduction and gametophytic generation. The process of Pollination and Fertilization. Variation. Natural vs artificial variation. Sources of natural variation and the Centers of origin. Inbreeding depression and Heterosis. The impact of inbreeding. Quantitative inheritance. Heritability. Selection methods for self pollinated crops.

Selection methods for cross pollinated crops. Variation in chromosome number (Polyploidy). Breeding for disease resistance. Basics of seed production. Self vs. Cross pollinated species. Hybrid seed production systems. Seed production case studies for Maize, Tomato, Cucumber). Crop genetic resources and seed conservation.

RECOMMENDED READING

Breeding Field Crops, by J. Poehlman Covers very well some general topics. Very good for specific crops of agronomic importance. AVI Publish. Co.

Principles of Plant Breeding, by A. Alard Good classic book (quite old but still in use!) John Willey.

Plant Breeding, by M. Hayward et. al. (CINEAM) Good book covers all main subjects. Also Biotechnology. Chapman & Hall.

Breeding for Disease Resistance by R. Johnson and G. Ellis. Good for specific topics. Kluwer Acad. Publishers.

Breeding Vegetable Crops, by M. Basset Very good for breeding the main vegetables AVI Publish. Co.

ASSESSMENT METHODS: Written exam

HOB.533 - **DNA Fingerprinting Technology** (3 ECTS)

LECTURER: Dr. G. Kotoulas, Dr. K. Tsingenopoulos

TYPE OF COURSE AND TEACHING METHODS: Laboratory

OBJECTIVE OF THE COURSE: To provide students hands on experience on molecular marker techniques such as RAPD, SSRs and AFLP

COURSE CONTENTS

This practical course will mainly focus on the AFLP technique, for which plant DNA will be extracted, and subjected to pre-amplification and amplification PCR reactions. The products of these reactions will be resolved on polyacrylamide gels, and exposed to film in order to visualize the variable DNA bands produced by using the different sets of primers. Finally the students will learn how the data produced is interpreted and may be used to evaluate genetic variability among plant samples.

RECOMMENDED READING

Plant Genotyping: The DNA Fingerprinting of Plants / by Robert J. Henry (2001),Molecular Markers, Natural History, and Evolution / by John C. Avise (April 2004).

Principles of Genetics / by D. Peter Snustad, Michael J. Simmons (July, 2002).

Modern Genetic Analysis, Second Edition: Integrating Genes and Genomes / by Richard C. Lewontin, Anthony J.F. Griffiths, Jeffrey H. Miller, William M. Gelbart (February, 2002).

Genetics of Populations / by Philip W. Hedrick (2004).

Genetics: Analysis of Genes and Genomes / by Daniel L. Hartl, Elizabeth W. Jones (August 2004).

Ecological Genetics: Design, Analysis, and Application / by Andrew Lowe, Stephen Harris, Paul Ashton, Blackwell Pub (June, 2004).

A Primer of Ecological Genetics / by Jeffrey K. Conner, Daniel L. Hartl (February, 2004).

Applied Molecular Genetics / by Roger L. Miesfeld (1999).

Handbook of Plant Biotechnology (Life Sciences) / by Paul Christou, Harry Klee (May, 2004).

Molecular Plant Biology (The Practical Approach, 259) / by Philip M. Gilmartin, Chris Bowler (July, 2002).

ASSESSMENT METHODS: Written exam

HOB.534 - **Arabidopsis Genetics** (3 ECTS)

LECTURER: Prof. K. Vlachonasios

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To introduce students into the advantages and disadvantages of Arabidopsis as a model plant for genetic studies.

COURSE CONTENTS

The adoption of A. thaliana by the plant genetics community as the model of choice has resulted in the generation of an enormous amount of information concerning the genetics and biology of this plant. As an introduction to this system, the general features of the plant will be discussed, and also the large number of Arabidopsis resources available to researchers on the Internet. In addition, the course will discuss how functional genomics in Arabidopsis are used to study biotic and abiotic stress.

RECOMMENDED READING

Arabidopsis: A Laboratory Manual, Chapters 1, 2, 3.

Arabidopsis, the Rosetta Stone of Flowering time?, G. G. Simpson and Caroline Dean, Science, vol. 296, 2002.

Arabidopsis transcriptome profiling indicates that multiple regulatory pathways are activated during cold acclimation in addition to the CBF cold response pathway, Sarah Fowler and M. F. Thomashow, The Plant Cell, vol. 14, 2002.

ASSESSMENT METHODS: Written exam

HOB.535 - **Mutant Analysis of Arabidopsis** (3 ECTS)

LECTURER: Dr. K. Kalantidis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide students with the available techniques for mutant analysis and how they are used to answer fundamental questions in plant biology

COURSE CONTENTS

Chemical mutagenesis is frequently used to generate plants displaying phenotypic alterations. The genetic lesions resulting in these characteristics may then be mapped and the genes involved in the modified phenotype can be identified by using reverse genetic techniques. In this unit mutation protocols, phenotypic analysis, and genome analysis will be described. In addition, the RNA interference technology will be presented extensively (advantages and disadvantages).

RECOMMENDED READING

Arabidopsis: A Laboratory Manual, Chapter 4.

Arabidopsis, Chapter 1: The Arabidopsis thaliana genome: towards a complete physical map.

Positional cloning in Arabidopsis. Why it feels good to have a genome initiative working for you, W. Lukowitz, C. Stewart Gillmor, W. Scheible, Plant Physiology, vol.123, 2000.

The art and design of genetic screens: Arabidopsis thaliana, D.R. Page and U. Grossiklaus, Nature Reviews, vol3, 2002.

Analysis of the genome sequence of the flowering plant Arabidopsis thaliana, The Arabidosis Genome Initiative, Nature, vol. 408, 2000.

Plant functional genomics, H. Holtorf, M.C. Guitton, R. Reski, Naturwessenschaften, vol. 89, 2002.

RNA interference – 2001, P.A. Sharp, Gene and development, vol. 15, 2001.

ASSESSMENT METHODS: Written exam

HOB.536 - **Arabidopsis Transformation & Analysis of Transgenic Plants** (3 ECTS) __

LECTURER: Prof. P. Chatzopoulos

TYPE OF COURSE AND TEACHING METHODS: Laboratory

OBJECTIVE OF THE COURSE: To introduce students into the nuts and bolts of agrobacterium-mediated transformation techniques and how it can be used in horticultural biotechnology

COURSE CONTENTS

A powerful technique to confirm a phenotypic trait assigned to a particular gene by reverse genetics is to demonstrate that the introduction of a modified gene or the disruption of its function gene will cause the same phenotype in normal plants. In this unit the processes by which particular genes are incorporated into recombinant vectors and introduced into Agrobacterium strains which are then used to infect and transform Arabidopsis plants mutants, and the isolation and analysis of the resultant recombinant progeny will be discussed.

RECOMMENDED READING

Plant transformation technology, C.A. Newell, Molecular biotechnology, vol. 16, 2000.

Lessons in gene transfer to plants by a gifted microbe, G. Hansen and M.D. Chilton.

ASSESSMENT METHODS: Written exam

HOB.541 - **Molecular Biology and Biochemistry of Fruit Ripening** (3 ECTS) _____

LECTURER: Prof. G. Casadoro

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To introduce students into the mechanisms of fruit ripening and how it can be regulated in horticultural crops

COURSE CONTENTS

Fruit ripening is a developmentally- and hormonally-regulated process that encompasses a wide range of cellular changes including fruit softening, chlorophyll degradation, anthocyanin production etc. The existence of a plethora of ripening mutants, detailed genetic maps and common transformation protocols have made the tomato (Lycopersicum esculentum) the model system for genetic, molecular and biochemical studies of fruit ripening. Emphasis will be given to molecular aspects of cell wall modifications during ripening. How genomics can be used to identify key components of ripening process. How biochemical events, such as carotenoid formation, are regulated during ripening..

RECOMMENDED READING

Regulation of Carotenoid Formation During Tomato Fruit Ripening and Development, Peter M. Bramley, Journal of Experimental Botany, vol 53, 2002.

Current Trends in the Embryology of Angiosperms, 2001, Chapter 17 - Parthenocarpy-State of the Art, Angelo Spena and Giuseppe Leonardo Rotino.

Molecular Aspects Of Cell Wall Modifications During Fruit Ripening, M. D. Brownleader et al., Critical Reviews in Food Science and Nutrition, Vol 39, 1999.

Cell Wall Metabolism in Fruit Softening and Quality and its Manipulation in Transgenic Plants, D. A. Brummell and M. H. Harpster, Plant Molecular Biology, Vol 47, 2001.

Molecular Biology of Fruit Maturation and Ripening, J. Giovannoni, Annu. Rev. Plant Physiol. Plant Mol. Biol., Vol 52, 2001.

Single Transduction Systems Regulating Fruit Ripening, L. Adams-Phillips et al., TRENDS in Plant Science, Vol 9, 2004.

Role of Cell Wall Hydrolases in Fruit Ripening, R. L. Fisher and A. B. Bennett, Annu. Rev. Plant Physiol. Plant Mol. Biol., Vol 42, 1991.

Biochemistry of Fruit Ripening. Edited by G. Seymour, J. Taylor and G. Tucker, 1993, Chapter 4 and Chapter 12.

Regulation of Fruit Dehiscence in Arabidopsis, Cristina Ferrandiz, Journal of Experimental Botany, Vol 53, Fruit Development and Ripening Special Issue, 2002.

Use of Genomics Tools to Isolate Key Ripening Genes and Analyse Fruit Maturation in Tomato, S. Moore et al., Journal of Experimental Botany, Vol 53, Fruit Development and Ripening Special Issue, 2002.

Increasing Antioxidant Levels in Tomatoes Through Modification of The Flavonoid Biosynthetic Pathway, M. E. Verhoeyen et al., Journal of Experimental Botany, Vol 53, Fruit Development and Ripening Special Issue, 2002.

ASSESSMENT METHODS: Written exam

HOB.542 - **Biotechnology of the Plant Hormone Ethylene** (3 ECTS)

LECTURER: Dr J. Pech

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To introduce students into the biology and biotechnology of the plant hormone ethylene and how affects the post-harvest behaviour of horticultural crops

COURSE CONTENTS

The plant hormone ethylene has profound effects on plant growth and development, including the induction of ripening in climacteric fruits, the promotion of seed germination, in the abscission of various organs and in senescence. The ethylene biosynthetic pathway has been determined and tremendous progress has been made towards elucidating the ethylene response signal transduction pathway, from signal perception to gene regulation. In addition to a general introduction to the topic, this class will focus on:

1. The manipulation of the ethylene biosynthetic genes in transgenic horticultural crops.

2. The genetic and molecular dissection of the ethylene response pathway.

RECOMMENDED READING

Fruit and Vegetable Biotechnology: V. Valpuesta Ed. Woodhead Pub Limited, Cambridge UK, 2002, ISBN 1 85573 467 2 Ed.

Ethylene, Agricultural Sources and Applications: M. Arshad and W.T. Frankenberger Ed. Kluwer Acad publisher, New York, 2002, ISBN 0 306 46666 X.

Ethylene in Plant Biology (second edition): F. Abeles and M.E. Salveit Eds, Academic Press, San Diego USA, 1992, ISBN 0 12 041451 1.

Plant Hormones, Biosynthesis, Signal Transduction, Action: P. Davies Ed., Kluwer Acad Pub. Dordrecht, NL, 2004, ISBN 1 4020 2684 6 (HB) ISBN 1 4020 2686 2 (e-book).

ASSESSMENT METHODS: Written exam

HOB.543 - **Nutritional Genomics** (3 ECTS)

LECTURER: Prof. A. Kanellis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide students an oversight of secondary metabolites with nutritional value, and how genetic engineering can alter the concentration of important metabolites from plants

COURSE CONTENTS

In the near future we will notice an unprecedented change in the production and range of available agro-foods. Functional foods, defined as those that affect beneficially one or more target functions in the body, will be produced and utilized more and more in the coming years. The scope of this class is to define classes of metabolites, such as ascorbic acid, analyze the metabolic pathways of their production and how these pathways can be engineered to produce functional foods.

RECOMMENDED READING

Plants as "Chemical Factories" for the production of polyunsaturated fatty acids, Research review paper, D. L. Alonso and F. G. Maroto, Biotechnology Advices 18, 200.

The biosynthesis and nutritional uses of crotenoids, Review, P. D. Fraser and P. M. Bramely, Progress in Lipids Research 43, 2004.

Plant L-ascorbic acid: Chemistry, Function, Metabolism, Bioavailability and Effects of Processing, Review, M. W. Davey et al., J Sci Food Agric 80, 2000.

Folic acid and folates: The Feasibility for nutritional enhancement in plant foods, Review, J. Scott et al., J Sci Food Agric 80, 2000.

Potential for increasing the content and bioavailability of Fe, Zn and Ca in plants for human nutrition, Review, E. Frossard et al., J Sci Food Agric 80, 2000.

The potential for the improvement of carotenoid levels in food and the likely systematic effects, Review, H. Van Den Berg et al., J Sci Food Agric 80, 2000.

Vitamin E, Review, PM Bramely et al., J Sci Food Agric 80, 2000.

Plant sterols: Biosynthesis, Biological Function and their Importance to Human Nutrition, Review, V. Piironen et al., J Sci Food Agric 80, 2000.

The nutritional significance, biosynthesis and bioavailability of glucosinolates in human foods, Review, R. F. Mithen et al., J Sci Food Agric 80, 2000.

Immuno-nutrition: Designer diets in cancer, Review Article, R. Imoberdorf, Support Care Cancer 5, 1997.

Vaccine antigen production in transgenic plants: Strategies, Gene Constructs and Perspectives, F. Sala et al., Vaccine, Vol.21, 2003.

Engineering vitamin E content: From arabidopsis mutant to Soy oil, A. L. Van Eenennaam et al., The Plant Cell, Vol. 15, 2003.

Improving iron, zinc and vitamin A nutrition through plant biotechnology, M. B. Zimmermann and R. F. Hurrell, Current Opinion in Biotechnology, Vol. 13, 2002.

Synthesis and turnover of folates in plants, A. D. Hanson and J. F. Gregory III, Current Opinion in Biotechnology, Vol. 5, 2002.

Increasing antioxidant levels in tomatoes through modification of the flavonoid biosynthetic pathway, M. E. Verhoeyen et al., Journal of Experiment Botany, Vol. 53, No. 377, 2002.

Antisense suppression of L-galactose dehydrogenase in Arabidopsis thaliana provides evidence for its Role in ascorbate synthesis and reveals light modulates L-galactose synthesis, S. Gatzek et al., The Plant Journal, Vol. 30(4), 2002.

Metabolic engineering of Xanthophyll content in tomato fruits, S. Dharmapuri et al., Federation of European Biochemical Societies (FEBS) Letters, Vol. 519, 2002.

Vitamin production in transgenic plants, K. Herbers, J. Plant Physiol. Vol. 160, 2003.

What is beneficial for health? The Concept of Functional Food, M. B. Roberfroid, Food and Chemical Toxicology, Vol. 37, 1999.

General introduction to the importance of genomics in food biotechnology and nutrition, C. T. Verrips et al., Current Opinion in Biotechnology, Vol. 12, 2001.

Metabolic engineering of an alternative pathway for ascorbic acid biosynthesis in plants, A. K. Jain and C. L. Nessler, Molecular Breeding, Vol. 6, 2000.

Over-expression of ascorbate oxidase in the apoplast of transgenic Tobacco results in ascorbate and glutathione redox states and increased sensitivity to ozone, Original article, M. Sanmartin et al., Planta, 2002.

Immunonutrition – supplementary amino acids and fatty acids ameliorate immune deficiency in critically Ill patients, H. Grimm and A. Kraus, New Surgical Horizons, Langenbeck's Arch Surg 386, 2001.

Flavonoid biosynthesis. A Colorful Model for Genetics, Biochemistry, Cell Biology, and Biotechnology, B. Winkel-Shirley, Plant Physology, Vol. 126, 2001.

Engineered polyamine accumulation in tomato enhances phytonutrient content, Juice Quality, and Vine Life, R. A. Mehta et al., Nature Biotechnology, Vol. 20, 2002.

ASSESSMENT METHODS: Written exam

HOB.544 - **CA Storage and Molecular Basis of Hypoxia** (3 ECTS)

LECTURER: Dr. P. Kalaitzis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide students with the basic principles of CA storage and the molecular basis of hypoxia

COURSE CONTENTS

Controlled Atmosphere storage: Physiological significance of CA storage, Differential effects on ripening process.

Hypoxia and metabolic adaptation: Oxygen status of cells and tissues. Metabolic adaptation and energy balance. Role of ethylene in hypoxic triggering.

Carnation flowers and Arabidopsis plants as models to study hypoxia triggering; State of the art on cut carnation flowers. Expression profiles under hypoxia in Arabidopsis. Oxygen sensors in prokaryotes.

Hypoxia sensing and signalling in mammalian systems.

RECOMMENDED READING

Power Point Presentation, notes provided.

Andrews DL, Drew MC, Johnson JR, Cobb BG, 1994.The response of maize seedling of different ages to hypoxic and anoxic stress. Plant Physiology 105, 53-60.

Chang WW, Huang L, Shen M, Webster , Burlingame AL, Roberts JK. 2000. Patterns of protein synthesis and tolerance of anoxia in root tips of maize seedlings acclimated to a low-oxygen environment, and identification of proteins by mass spectrometry. Plant Physiology 122, 295–318.

Chang C, Meyerowitz E. 1986. Molecular cloning and DNA sequence of the Arabidopsis thaliana alcohol dehydrogenase gene. Proceedings of the National Academy of Sciences of the United States of America 83, 1408 1412.

Chen X, Solomos T, 1996. Effects of hypoxia on cut carnation flowers (Dianthus caryophillus L.): longevity, ability to survive under anoxia and activities of alcohol dehydrogenase and pyruvate kinase. Postharvest Biology and Technology 7,317-329.

Dolferus R, Jacobs M, Peacock WJ, Dennis ES. 1994. Differential interactions of promoter elements in stress responses of the Arabidopsis Adh gene. Plant Physiology 105, 1075-1087.

Dolferus R, Marbaix G, Jacobs M. 1985. Alcohol dehydrogenase EC 1.1.1.1 in Arabidopsis analysis of the induction phenomenon in plantlets and tissue cultures. Molecular and General Geneics 199, 256-264.

Drew, M.C. 1997. Oxygen deficiency and root metabolism: Injury and acclimation under hypoxia and anoxia. Annual Review of Plant Physiology and Plant Molecular Biology 48, 223-250.

Droillard MJ, Bureau D, Paulin A, Daussant J. 1989. Identification of different classes of superoxide dismutase in carnation petals. Electrophoresis 10(1), 46-8.

Ellis MH, Dennis ES, Peacock WJ, 1999.Arabidopsis roots and shoots have different mechanisms for hypoxic stress tolerance. Plant Physiology 119, 57-64.

Freeling M, Bennett DC .1985. Maize Adhl. Annual Review of Geneics 19, 297-323.

Geigenberger P, Fernie AR, Gibon Y, Christ M, Stitt M. 2000.Metabolic activity decreases as an adaptive response to low internal oxygen in growing potato tubers. Biol. Chem. 381, 723-740.

Hagermann RH, Flesher D. 1960.The effect of anaerobic environments on the activity of alcohol dehydrogenase and other enzymes in corn seeds. Archives of Biochemistry and Biophysics 87, 203-209.

Hoeren F, Dolferus R, Wu Y, Peacock WJ, Dennis ES. 1998. Evidence for a role for AtMYB2 in the induction of the Arabidopsis alcohol dehydrogenase (ADH1) gene by low oxygen. Genetics 149, 479–490.

Ismond KP, Dolferus R, De Pauw M, Dennis ES, Good AG. 2003. Enhanced low oxygen survival in Arabidopsis through increased metabolic flux in the fermentative pathway. Plant Physiology 132, 1292-1302.

Jacobs M, Dolferus R, Van Den Bosshe VB. 1988. Isolation and biochemical analysis of ethyl methyl sulfonate induced alcohol dehydrogenase null mutants of Arabidopsis thaliana (L.) Heynh. Biochemical Genetics 26, 102 112.

Jones ML, Woodson WR. 1999. Differential expression of three members of the 1-aminocyclopropane-1 carboxylate synthase gene family in carnation. Plant physiology 119(2), 755-64.

Kader AA. 1986. Biochemical and physiological basis for effects of controlled and modified atmospheres on fruit and vegetables.Food technology 40(5), 94-104.

Kanellis AK, Solomos T, Mattoo A. 1989. Hydrolytic enzyme activities and protein pattern of avocado fruit stored in low oxygen atmosphere. Plant Physiology 90, 257-266

Ke DL, Goldstein M, O'Mahony, Kader A. 1991. Effects of short term exposures to low O2, or high CO2 atmospheres on quality attributes of strawberries. J. Food Sci. 56, 50-54.

Kelley PM, 1989, Maize pyruvate decarboxylase m RNA is induced anaerobically. Plant Molecular Biology 13, 213-222.

ASSESSMENT METHODS: Written exam

HOB.545 – **Advanced GMO Detection Methodologies (Lab)** (3 ECTS) _____

LECTURER: Dr. O. Koutita

TYPE OF COURSE AND TEACHING METHODS: Laboratory

OBJECTIVE OF THE COURSE: To provide hand on experience on GMO detection using PCR technology

COURSE CONTENTS

The latest techniques for the analysis of genetically modified common agricultural produce (soya, maize, cotton, tomato), and their products will be demonstrated.

The lab will include the sampling methodology necessary to establish the status of the produce with regard to its transgenic element content, and to examine for possible contamination of non-transgenic produce. DNA isolation will be carried out on various samples of seeds, fruits and their processed products. PCR analysis of these samples will then be performed to confirm the presence of species-specific marker genes, and to test for the presence of defined transgene sequences, and other genetic elements commonly found in transformed plant strains.

RECOMMENDED READING

Detection of genetically modified organisms (GMOs) by PCR: a Brief review of methodolgies available, Review, E. Gachet et al., Trends in food science and technology 9, 1999.

PCR detection of genetically modified Soya and Maize in foodstuffs, C. D. Hurst et al., Molecular Breeding 5, 1999.

Detection of genetically modified organisms in foods, Review, Farid E. Ahmed, Trends in Biotechnology, Vol.20 No.5, 2002.

ASSESSMENT METHODS: Written exam

HOB.546 - **Environmental Risk Assessment of GMOs** (3 ECTS) _____

LECTURER: Prof. M. Wilkinson

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To introduce students into the concepts of the potential risk of GMO release into the environment

COURSE CONTENTS

The potential environmental risks due to gene flow from genetically modified crops into wild plant populations are currently of great concern. Methodologies will be described for the detection of hybridization between genetically modified plants and their wild relatives, including PCR–based analyses such as ISSR and RAPD. In addition, the possible consequences of the accidental introduction of transgenes into other plants will be discussed and elaborated.

RECOMMENDED READING

Risk assessment of GM plants: Avoiding gridlock?, M. J. Wilkinson et al., Opinion, Trends in Plant Science, Vol.8 No.5, 2003.

Hybridisation between Brassica napus and B. rapa on a national scale in the United Kingdom, M. J. Wilkinson and al., Science, vol.302, 2003.

Gene flow and introgression from domesticated plants into their wild relatives, N. C. Ellstrand et al., Annu. Rev. Ecol. Syst. 30, 1999.

ASSESSMENT METHODS: Written exam

Laboratory of Plant Biotechnology and GMO Tesing

The laboratory of Plant Biotechnology & GMO Testing serves two purposes: a) to provide the infrastructure for training of students and support the research interests of the Horticultural Genetics & Biotechnology Department. b) To offer services to food industries on qualitative and quantitative analysis for the presence of GMOs in agricultural products.

The research interests of this laboratory focus on plant physiology, post-harvest biotechnology and technology, Arabidopsis genetics and development of GMO testing technology.

The molecular basis of hypoxic and anoxic response

Molecular signalling in plant senescence

The molecular characterization of the abscission process and its manipulation to improve crop characteristics using cotton as model plant

DNA genotyping of horticultural crops such as olives

Development of quantitative GMO standards for cotton

The facility includes an extended line–up of up–to–date computer–assisted apparatae, including: Automated (Capillary) DNA Sequencing Apparatus, Real Time / Quantitative PCR, 2 PCR Thermo–cyclers, In–situ PCR, 2 Centrifuges (up to 24,000 rpm), Bench–top Centrifuges (up to 6,000 rpm), microcentrifuges, DNA and protein Electrophoresis Apparatae, Shaking Incubators, Microscopes linked to digital camera, Microtome, Laminar Flow, Gel Documentation System, Autoclave, a Photosynthesis meter, Controlled Environment Chambers, Deep Freeze Chambers (-70^{o}C), Cold Rooms (4^{o}C), Tissue Culture Room, Growth Room, Radioactive Work Room, Photo dark room.

This laboratory supports the following research sector:

Laboratory of Plant Molecular Histology

This facility is part of the Plant Biotechnology & GMO Testing laboratory and comprises infrastructure necessary for histochemical staining of plant tissues, in-situ hybridization and in-situ PCR experiments. The equipment includes a state of the art LEICA RM2155 microtome, an Applied Biosystems in-situ PCR, a LEICA EG1140H Parafin embedding station, a LEICA EG1140C cooling plate and a LEICA TP1020 automatic tissue processor.

Laboratory of Horticultural Products Quality

This facility is part of the plant biotechnology laboratory and comprises infrastructure necessary for post-harvest quality assessment of fruits and vegetables. The equipment includes a gas-chromatograph, facility for controlled atmosphere experiments, an oxygen/CO_2 analyzer and necessary equipment for assessing the physicochemical properties of hort products.

MASTERS OF SCIENCE PROGRAM

Research Project (9 month duration)

Requirement

60 ECTS credits. Laboratory techniques (Related to the subject of the Master Thesis)

Research Subject Areas (topics generally available for Master of Science thesis)**:**

- Molecular signalling in plant senescence using as models cut carnation flowers and tomato fruits in order to extend the storage life of horticultural products
- The molecular basis of hypoxic and anoxic response using Arabidopsis as model plant
- Development of quantitative GMO standards for crops such as cotton
- DNA genotyping of horticultural crops such as olives and their food derivatives

Indicative master thesis realized within the area

TITLE: The Use of RNA Interference to Knockout Arabidopsis P4H Genes (2004)
AUTHOR: Ihab Lolas
PLACE OF REALIZATION: MAICh, Greece
THESIS DIRECTORS: Dr. Kriton Kalantidis, Greece, Dr. Panagiotis Kalaitzis, Greece

TITLE: Assessing Olive Biodiversity by Genomic AFLP Methodology (2003)
AUTHOR: Elena Craita Bita
PLACE OF REALIZATION: MAICh, Greece
THESIS DIRECTOR: Prof. Polydevkis Chatzopoulos, Greece, Dr. Panagiotis Kalaitzis, MAICh, Greece

TITLE: Expression Profile of the Arabidopsis Prolyl 4-Hydroxylase Gene Family in Response to Hypoxia (2003)
AUTHOR: Daniela Vlad, Agronomist, Romanian
PLACE OF REALIZATION: MAICH, Greece
THESIS DIRECTOR: Dr. Panagiotis Kalaitzis, MAICh, Greece

TITLE: A Study on the Expression of the P4H7 and HSAP90 Genes in Response to Hypoxia and Anoxia (2004)
AUTHOR: Rachid Ben Hamm, Moroccan
PLACE OF REALIZATION: MAICh, Greece
THESIS DIRECTORS: Prof. Polydevkis Chatzopoulos, Greece, Dr. Panagiotis Kalaitzis, MAICh, Greece

TITLE: Supression of a Cotton Actin Transcript by Ethylene (2003)
AUTHOR: Amal Bijamane, Moroccan
PLACE OF REALIZATION: MAICh, Greece
THESIS DIRECTORS: Dr. Nikiforos Kapranos, Greece, Dr. Panagiotis Kalaitzis, MAICh, Greece

TITLE: Development of Scar Markers Linked to Resistance to *Fusarium Oxysporum* F.Sp. *Cucumerium* in Cucumber (*Cucumis sativus*) (2004)
AUTHOR: Emad Jaber, Jordan
PLACE OF REALIZATION: Heraklion, Greece
THESIS DIRECTORS: Dr. Andreas Doulis, Dr. Demetrios Vakalounakis, Greece

TITLE: Alternative Methods to Control Botrytis cinerea and Preserve the Quality of Hayward Kiwifruit (2004)
AUTHOR: Kamer Cetiz, Turkey

PLACE OF REALIZATION: MAICh
THESIS DIRECTOR: Prof. Anastasia Lagopodi, Greece, Prof. E. Sfakiotakis, Greece

TITLE: High CO2 Storage of Truffles in Air-Tight and Temperature Insulated Shipping Box and its Effects on Polyphenoles, Polyamides, Antioxidant Activity,k ADH and LDH Activity (2001)
AUTHOR: Shady Hajjar, Lebanon
PLACE OF REALIZATION: MAICh, Greece and University of Viterbo, Italy
THESIS DIRECTOR: Prof. F. Mencarelli, Italy

References of the main academic staff teaching within the M.Sc.

More than 30 invited lecturers from about 6 countries participate in each edition of the M.Sc. programme of which, 45% came from Research Centres, 45% from Higher Education Institutions, 10% from Private Companies and 5% from International Centres. Considering their implication in the programme, the following academic staff is taken as reference (Annex I includes further details of these lecturers):

GREECE
Higher Education Institutions
- E. Tsouvelekas, University of Rethymnon
- N. Fanourakis, Technical Educational Institution, Heraklion
- K. Vlachonasios, A. Tsaftaris, A. Kanellis, E. Sfakiotakis, D. Gerasopoulos, Aristotle University of Thessaloniki
- G. Nanos, University of Thessaly
- P. Chatzopoulos, Agricultural University of Athens

Research Centres
- K. Sekeris, National Research Institute
- D. Kafetzopoulos, K. Kalantidis, Institute of Molecular Biology
- Dr. G. Kotoulas, Dr. K. Tsingenopoulos, Institute of Sea Biology
- O. Koutita, Hellenic Sugar Industry

Private Companies
- Mrs. K. Grogoriadou, Mr. N. Leventakis, Mr. Chr. Dovas, Vitro Hellas

FRANCE
- J.C. Pech, ENSAT

ITALY
Higher Education
- E. Rugini, University of Tuscia
- G. Casadoro, University of Padova

SPAIN
Research Centres
- Jordi Garcia Mas, Pere Arus, Laboratori de Genètica Molecular Vegetal CSIC-IRTA, Cabrils-Barcelona

UNITED KINGDOM
Higher Education Institutions
- M. Wilkinson, Reading University

UNITED STATES

Higher Education Institutions

- E. Moudrianakis, John-Hopkins University
- J. Scandalios, North Carolina State University

The Institute reserves the right to replace its visiting faculty according to its evaluation process.

Food Quality Management and Chemistry of Natural Products

Postgraduate Specialisation and M.Sc. Programme

SCIENTIFIC COORDINATOR: **Dr. Panagiotis Kefalas**

EDUCATIONAL AND PROFESSIONAL GOALS

The Master on Food Quality Management and Chemistry of Natural Products provides a two-year programme for graduates holding a University Bachelors' degree in Chemistry, Agriculture, or other related sciences.

In the first year participants follow the Postgraduate Specialisation Course. The objectives of this Course are to: i) provide advanced knowledge in the areas of food chemical composition and food microbiology; ii) introduce indispensable notions of quality and safety in all levels of production of food or other products; iii) present current advances for the isolation, characterisation and application of natural products in the industry; iv) provide laboratory experience in food and natural product analysis; v) merge quality assurance requirements with the development, processing, preservation and packaging of edible products.

Laboratory exercises combined with these courses provide a practical and tangible perspective. The qualified first year graduates are entitled of pursuing their research in an environment fully equipped with the most updated facilities.

In the second year, students who have successfully completed the first year develop a thesis based on research leading to a Master's of Science degree.

The scientific results of graduate studies are usually announced in International Conferences and/or published in International Peer Review Scientific Journals

POST GRADUATE SPECIALISATION PROGRAMME

The programme is organised in 5 sections

Section I - Introductory Discipline

The cycle includes introductory courses on Scientific English, use of Computer and Statistics.

Section II - Fundamental Overviews

The cycle intends to strengthen the background of the students in order to form a solid base, upon which the rest of the course will be based. It includes: an overview of organic and analytical chemistry and the indispensable statistics and uncertainty evaluation as tools.

Section III - Advanced Food Chemistry

The cycle is devoted to a detailed study of advanced themes in food chemistry and chemical analysis. The very important topic, nowadays, on functional foods is included, together with food microbiology.

Section IV - Chemistry of Natural Products

The cycle focuses on the chemistry of natural products, as viewed through the study of specific families (alkaloids, terpenoids, flavonoids) and the laboratory techniques used for their isolation, identification and analysis. Their biosynthetic and metabolic paths are also included.

Section V - Topics in Food Sciences

The cycle focuses on other aspects of food production with reference to safety, preservation, quality assurance, legislation and chemical approach to the identification of specific origin.

TRAINING SEQUENCE

Section I - Introductory Discipline [7 ECTS]
from October to November

FQC.501 - Scientific English (3 ECTS)

FQC.502 - Introductory Computing (1 ECTS)

FQC.503 - Statistical Procedures (3 ECTS)

Section II - Fundamental Overviews [6 ECTS]
November

FQC.511 - Organic Chemistry (3 ECTS)

FQC.512 - Analytical Chemistry I (3 ECTS)

Section III - Advanced Food Chemistry [18 ECTS]
from November to February

FQC.521 - Foods/Lipids/Antioxidants (3 ECTS)

FQC.522 - Water Relations in Food - Food Carbohydrates (3 ECTS)

FQC.523 - Food Microbiology (3 ECTS)

FQC.524 - Food Protein and Enzymes (3 ECTS)

FQC.525 - Analytical Chemistry II (3 ECTS)

FQC.526 - Functional Foods and Bioactive Ingredients (3 ECTS)

Section IV - Chemistry of Natural Products [15 ECTS]
from February to March

NPB.522 - Biochemistry of Secondary Metabolism (3 ECTS)

NPB.523 - Chemistry of Terpenoids and Essential Oils (3 ECTS)

NPB.524 - Chemistry of Alkaloids, Flavonoids and Other Phenolics (3 ECTS)

FQC.534 - Laboratory Techniques I (3 ECTS)

FQC.535 - Laboratory Techniques II (3 ECTS)

Section V - Topics in Food Sciences [18 ECTS]
from March to June

FQC.541 - New Concepts in Food Packaging (3 ECTS)

FQC.542 - Trends in Food Processing-Preservation Technologies (3 ECTS)

FQC.543 – Food Product Development & Predictive Modeling of Food Quality (3 ECTS)

FQC.544 - Food Legislation (3 ECTS)

FQC.545 - Products of Appellation of Origin (3 ECTS)

FQC.546 - Quality Assurance (3 ECTS)

ANALYTICAL SYLLABUS

FQC.501 - **Scientific English** (3 ECTS)

LECTURER: Mrs Linda Lucas

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: The development of scientific writing and communication skills.

PREREQUISITES: Good knowledge in English language.

COURSE CONTENTS

Note-taking skills in order to better understand lectures; the study of scientific texts and their development; terminology related to the students' chosen field; a review of the fundamentals of English grammar with a view to studying advanced grammar skills for the purposes of writing a M.Sc. thesis; development of academic writing skills; public speaking, communication skills and theme-related discussions based on the students' chosen field of study. The final grade is awarded on the basis of the following:

- examination marks (based on grammar and scientific texts);
- presentation marks (based on oral and written presentations of students' own work);
- participation in classwork and attendance; homework assignments.

RECOMMENDED READING

Papers provided by the instructor.

ASSESSMENT METHODS: Written exam, Project Presentation

FQC.502 - **Introductory Computing** (1 ECTS)

LECTURER: Mr. Nicolas Boretos

TYPE OF COURSE AND TEACHING METHODS: Computer-assisted teaching

OBJECTIVE OF THE COURSE: Introduce scientists to the computer-based resources available.

PREREQUISITES:

COURSE CONTENTS

Computer hardware components, peripherals and controllers; architecture; operating systems. Interacting with computers. Data communications and computer networks. The Internet; brief history, protocols, addressing and domain name service(DNS). E-mail, News-Groups, Telnet, Ftp, WWW (World Wide Web). Computer applications; word processing, spread-sheets, data-bases, graphics, scientific software, schedulers. Computer Security.

RECOMMENDED READING

European Computing Driving Licence.

ASSESSMENT METHODS: Written exam, Computer-Assisted Exam

FQC.503 - **Statistical Procedures** (3 ECTS)

LECTURER: Prof. A. Papadopoulos

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Basic concepts and theories in statistics.

PREREQUISITES: Fundamentals of statistics.

COURSE CONTENTS

Descriptive statistics, frequency distributions measures of central tendency and dispersion. Probability distributions: Binomial, Hypergeometric, Poisson, Normal, X2, Student-t and F. Statistical inference: estimation and hypothesis testing. Simple and multiple regression.

RECOMMENDED READING

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam

FQC.511 - **Organic Chemistry** (3 ECTS)

LECTURER: Dr. Anastasia Detsi

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Strengthen the background of the students and provide advanced knowledge in organic chemistry, which is one of the indispensable tools in the field of natural products.

PREREQUISITES: Knowledge of fundamentals in chemistry, undergraduate organic chemistry.

COURSE CONTENTS

Nomenclature, reactions, mechanisms, stereochemistry, asymmetry, families of compounds that are encountered in food chemistry, laboratory practice.

RECOMMENDED READING

Organic Chemistry by T. Solomon.

Organic Chemistry by J. McMurry, Publisher Brooks Cole; 6th Edition, 2003.

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam

FQC.512 - **Analytical Chemistry I** (3 ECTS)

LECTURER: Prof. Antonios Calokerinos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Strengthen the background of the students and provide advanced knowledge in analytical chemistry.

PREREQUISITES: Knowledge of fundamentals in chemistry, undergraduate analytical chemistry.

COURSE CONTENTS

Chemical equilibrium, buffers, complexes, titrations, redox potential, laboratory practice.

RECOMMENDED READING

Fundamentals of Analytical Chemistry, Douglas A., Skoug F., James Holler, Donald M. West.

Analytical Chemistry, Gary D. Christian.

Quantitative Chemical Analysis, Daniel C. Harris.

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam, Project Presentation

FQC.521 - **Foods/Lipids/Antioxidants** (3 ECTS)

LECTURER: Prof. Dimitrios Boskou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of lipids and their function, as well as in the field of antioxidants.

PREREQUISITES: Undergraduate food chemistry.

COURSE CONTENTS

Chemistry of oils and fats, free radical chemistry, reactive oxygen, photosensitised oxidation, metal catalysed reactions. Antioxidants: chemistry and mechanisms of action, techniques of evaluation of antioxidant activity, uses.

RECOMMENDED READING

Chemical and Functional Properties of Food Lipids, A. E. Sikorski, Edit., CRC Press Boca Rn, 2003.

Steinhart H. and Blemoth, G., Lipids in Novel Foods, Eur. J. Lipid Sci Technol., 2001, 103, 40-41.

Fennema, O. R., Food Chemistry, Marcel Dekker Inc, N.Y., 1985.

Boskou, D., Olive Oil, Chemistry and Technology, AOCS Press, Chasmpaign Illinois, 1996.

Pokorny, J. Yanishlieva N. and M. Gordon, Antioxidants in Food, CRC Press, Boca Raton, 2001.

Bidlack, W. R., Phytochemicals. A new Paradigm, Technomoc Publ Co, Lancaster, 1998.

ASSESSMENT METHODS: Written exam

FQC.522 - **Water Relations in Food - Food Carbohydrates** (3 ECTS)

LECTURER: Prof. Constantinos Biliaderis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the understanding of interactive mechanisms between water and carbohydrates in food.

PREREQUISITES: Undergraduate food chemistry.

COURSE CONTENTS

Water relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymic, physical and microbial changes). Glass transitions and molecular mobility in foods, their relevance to quality and stability of food products. State diagrams and strategies to enhance quality and shelf life of food systems. Food Carbohydrates: structural, analytical, physicochemical, nutritional and functional aspects of small mol. wt. carbohydrates and polysaccharides of plant and microbial origin.

RECOMMENDED READING

Modified Starches in Foods (1983), E. Trimble, Journal of Consumer Studies and Home Economics, 7, 247-260,

Glass transitions and product stability-an overview(1995), Food Hydrocolloids, Vol. 9 no. 4, p. 307-315.

The structure and interactions of starch with food constituents (1991), J. Physiol. Pharmacol. 69: 60-78.

Fat Replacers, (1998), Casimir C. Akoh, Food Technology, Vol. 52, no 3.

Water Activity in Foods: G. B. Barbarosa-CAnovas, A. J. Fontana, S. Schmidt, T. P. Labuza, 2004, Blackwell Publishing.

Polysaccharide Association Structures in Food, 1998, R. H. Walter, Marcel Dekker, Inc.

Food Chemistry, 3rd Edition, O. R. Fennema, 1996, Marcel Dekker (paper cover).

ASSESSMENT METHODS: Written exam

FQC.523 - **Food Microbiology** (3 ECTS)

LECTURER: Dr. Zeina Kassaify

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in food microbiology

PREREQUISITES: Undergraduate food chemistry and/or basics of biology.

COURSE CONTENTS

Microbial growth in food: intrinsic, extrinsic and implicit factors. Microbial interactions. Inorganic, organic and antibiotic additives. Effects of enzymes and other proteins. Combination systems. Adaptation phenomena and stress phenomena. Effect of injury on growth or survival. Commercial available databases.

RECOMMENDED READING

James M. Jay, Modern Food Microbiology 6th Edition.

Ray, B. 1996. Fundamental Food Microbiology

ASSESSMENT METHODS: Written exam

FQC.524 - **Food Protein and Enzymes** (3 ECTS)

LECTURER: Ass. Prof. Efie Tsakalidou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in understanding the role of food proteins, as well as the functions of enzymes.

PREREQUISITES: Undergraduate food chemistry.

COURSE CONTENTS

Chemistry and structure of food proteins, enzymic reactions, kinetics, Maillard reactions, enzymic browning.

RECOMMENDED READING

Plasmin in Milk and Dairy Products: an Update (1996), E. C. Bastian and R. J. Brown, Int. Dairy Journal 6, p. 435-457.

The ifluence of ultimate pH and intramuscular fat content on pork tenderness and tenderization (2001), R. L. J. M. van Laack, S. G. Stevens, and K. J. Stalder, American Society of Animal Science, 79: 392-397.

Isolation and Identification of Some Major Water-soluble Peptides in Feta Cheese (1998), A. .Michaelidou, E. Alichanidis, H. Urlaub, A. Polychroniadou and G. K. Zerfiridis, J. Dairy Sci 81: 3109-3116.

The Presence of Oxidizing Enzyme activities in Virgin Olive Oil (1998), M. D. Georgalaki, T. G. Sotiroudis and A. Xenakis, JAOCS, Vol. 75, no 2, p. 155-159.

Protein Structure and Function, Stryer L. (1998) Biochemistry, W. H. Freeman & Co., NY, p. 15-40, Ch. 2.

Introduction to Enzymes, Stryer L. (1998) Biochemistry, W. H. Freeman & Co., NY, p. 177-198, Ch. 8.

Cereal Proteins, Eskin M. N. A. (1990) Biochemistry of Foods, Academic Press Inc., NY, p. 176-182, 297-307 and 335-343.

Milk Proteins, Fennema O. R. (1996) Food Chemistry, Marcel Dekker Inc., NY, p. 846-849 & 854-863.

Meat Proteins, Fennema O. R. (1996) Food Chemistry, Marcel Dekker Inc., NY, p. 884-897 & 913-914.

Enzymatic browning, Eskin M. N. A. (1990) Biochemistry of Foods, Academic Press Inc., UK, p. 401-415, Ch. 9.

ASSESSMENT METHODS: Written exam

FQC.525 - **Analytical Chemistry II** (3 ECTS)

LECTURER: Prof. Antonios Calokerinos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: Provide expertise in analysis focusing on analytical instrumentation.

PREREQUISITES: Undergraduate analytical chemistry.

COURSE CONTENTS

Special advanced topics on analytical chemistry. Introduction to Chemical instrumentation, basic components of analytical instruments, optical detectors (photomultipliers, monochromators, etc.), electrical detectors (pH-electrodes, etc), miscellaneous detectors. Atomic and molecular emission, absorption and fluorescence spectroscopy, Basic principles of analytical instrumentation used in Food Quality, Quality control of food and containers, migration of metals and compounds from container into food. Case studies.

RECOMMENDED READING

The content of heavy metals in food packaging paper boards: an atomic absorption spectroscopy investigation (1997). Marcelo E. Conti, Food Research International, Vol. 30, No 5, p. 343-348.

Determination of manganese and chromium in foods by atomic absorption spectrometry after wet digestion (1997). U. Tinggi, C. Reilly and C. Patterson, Food Chemistry, Vol. 60, No 1, p. 123-128.

The content of heavy metals in food packaging paper: an atomic absorption spectroscopy investigation (1997). M. E. Conti and F. Botre, Food Control, Vol. 8, No 3, p. 131-136.

The determination of lead in preserved food by spectrophotometry with dibromohydroxyphenylporphyrin (2004). Zaijun Li, Jian Tang, Jiaomai Pan, Food Control 15, p. 565-570.

Application of the assay of aflatoxins by liquid chromatography with fluorescence detection in food analysis (2000). Journal of Chromatography A, 882, p. 1-10.

Determination of fluoride in food by the use of alkali fusion and fluoride ion-selective electrode (2001). Marian Kjellevold Malde, Kjell Bjorvatn, Kare Julshamn, Food Chemistry 73, p. 373-379.

Power Point presentation.

ASSESSMENT METHODS: Written exam

FQC.526 - **Functional Foods and Bioactive Ingredients** (3 ECTS)

LECTURER: Dr. Jerzy Zawistowski

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of neutraceuticals.

PREREQUISITES: Undergraduate food chemistry.

COURSE CONTENTS

Healthy natural foods, fortified foods, neutraceuticals, minerals, vitamins, phytosterols, polyphenols, phytoestrogens, ω-fatty acids, glucosinolates, non-digestible oligosaccharides, prebiotic cultures.

RECOMMENDED READING

Potential Benefits of Functional Foods and Nutraceuticals to reduce the risk and Costs of Diseases in Canada, B. J. Holub, February 2002, Revised version: May 28/02.

The flavonoids quercetin and catechin synergistically inhibit platelet function by antagonizing the intracellular production of hydrogen peroxide (2000). P. Pignatelli,k F. M. Pulcinelli, A. Celestini, L. Lenti, A. Ghiselli, P. P. Gazzaniga and F. Violi. American Journal for Clinical Nutrition, 72 : 1150-5.

A new direction in health care: preventive model for health care using functional foods, nutraceuticals desperately needed in Canada, June 18,2003. Guelph Bruce Holub, http://www.uoguelph.ca/atguelph/.

Conjugated linoleic acid supplementation for 1 y reduces body fat mass in healthy overweight humans1-3 (2004). Jean-Michel Gaullier, J. Halse, K. Hoye, K. Kristiansen, H. Fagertum, H. Vik and O. Gudmundsen, American Journal for Clinical Nutrition, 79: 1118-25.

Functional Foods – A New step in the evolution of food development (2004). Jerzy Zawistowski and David D. Kitts.Clinical Nutrition Rounds, Vol. 4, Issue 4.

Power Point Presentation.

ASSESSMENT METHODS: Written exam

NPB.522 - **Biochemistry of Secondary Metabolism** (3 ECTS)

LECTURER: Dr. Joerg Degenhardt

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: A thorough overview of plant secondary metabolism.

PREREQUISITES: Good knowledge in Organic Chemistry, Biochemistry, Molecular Biology and Plant Physiology.

COURSE CONTENTS

Introduction to plant metabolism. Plant structure and cell structure. Chemical nomenclature, the logic of metabolism and reaction mechanisms. Building blocks-biosynthetic pathways. Shikimate, mevalonate, methylerythritol phosphate pathway, glyceraldehyde-3-phospate/ pyruvic acid pathway.

Important secondary metabolite groups: Fatty acids and polyketides, phenylpropanoids and lignin, terpenoids and steroids, tropane alkaloids, terpenoid indole alkaloids.

Gene regulation in secondary metabolism. Tissue specificity (phenylpropanoids) and stress responsiveness (terpenoid indole alkaloids). Compartmentation, storage and transport.

RECOMMENDED READING

Biochemistry & Molecular Biology of Plants, Buchanan, Gruissem and Jones, Ch. 24.

Plant Physiology, 2nd Edition, Taiz and Zeiger, Ch. 13.

Power Point Presentation.

ASSESSMENT METHODS: Written exam

NPB.523 - **Chemistry of Terpenoids and Essential Oils** (3 ECTS)

LECTURER: Ass. Prof. Vassilios Roussis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of fragrance and flavour through the prism of chemistry and industrial approach.

PREREQUISITES: Organic Chemistry.

COURSE CONTENTS

Fragrance and flavouring compounds : essential oils, terpenoids-oleoresins- Detailed biochemical pathways for the production of volatile compounds in specific plant species; Chemical structure, distribution, diurnal and seasonal fluctuations; Infraspecific differences in volatiles oil production, differentiation between geographical origins; Turpentine and terpene industry and, biological activity). Raison d'être.

RECOMMENDED READING

Methods in Plant Biochemistry, 1991, Barry V. Charlwood and Derek V. Banthorpe, Vol. 7, Ch. 1, Ch. 4 and Ch. 5.

ASSESSMENT METHODS: Written exam

NPB.524 - **Chemistry of Alkaloids, Flavonoids and Other Phenolics** (3 ECTS)

LECTURER: Ass. Prof. E. Kokkalou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced notions of the chemistry and pharmacology of various natural products.

PREREQUISITES: Undergraduate organic chemistry.

COURSE CONTENTS

Pharmacological action of alkaloids : Pyridine-piperidine alkaloids, Tropane alkaloids, quinoline alkaloids, isoquinoline alkaloids, indole alkaloids, imidazole alkaloids, steroidal alkaloids. Detailed biochemical pathways for the production of alkaloids in specific plant species. Chemical structures, subcellular localization, distribution and evolution in gymnosperms and angiosperms, biological activity & role of alkaloids in plants.Detailed biochemical pathways for the production of flavonoids in specific plant species. Chemical structures, subcellular localization, natural distribution and evolution in gymnosperms and angiosperms. Biological activity: role of flavonoids in plants, Natural pigments:anthocyanins-flavonoids-other phenolic compounds and other miscellaneous natural pigments.

RECOMMENDED READING

The Systematic Identification of Flavonoids, 1970, Marby and Thomas Markham, Published by Springer Vertag.

ASSESSMENT METHODS: Written exam

FQC.534 - **Laboratory Techniques I** (3 ECTS)

LECTURER: Dr. Anastasia Detsi

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: To provide knowledge and know how over techniques and methodologies applied in chemical laboratories for food and natural products.

PREREQUISITES: Undergraduate organic chemistry or undergraduate analytical chemistry.

COURSE CONTENTS

Theory of chromatography, instrumental techniques (GC, HPLC) and applications, principles of mass spectroscopy and applications (LC-MS, GC-MS), principles of photospectroscopy, other spectroscopic methods (IR, NMR), identification, quantitation, structural determination, laboratory exercises.

RECOMMENDED READING

Basic Gas Chromatography-Mass Spectrometry by F.W. Karasek and R.E. Clement.
Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam

FQC.535 - **Laboratory Techniques II** (3 ECTS)

LECTURER: Dr. Dimitrios Makris

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: As continuation of "Laboratory techniques I", the course provides knowledge and know how over techniques and methodologies applied in chemical laboratories for food and natural products.

PREREQUISITES: Undergraduate organic chemistry or undergraduate analytical chemistry.

COURSE CONTENTS

Theory of chromatography, instrumental techniques (GC, HPLC) and applications, principles of mass spectroscopy and applications (LC-MS, GC-MS), principles of photospectroscopy, other

spectroscopic methods (IR, NMR), identification, quantitation, structural determination, laboratory exercises.

RECOMMENDED READING

Laboratory Techniques, Dimitris Makris, Ph.D. AMRSC, 2005

ASSESSMENT METHODS: Written exam

FQC.541 - **New Concepts in Food Packaging** (3 ECTS)

LECTURER: Dr. George Boskou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide advanced knowledge in packaging technology.

PREREQUISITES: Undergraduate food technology or food chemistry.

COURSE CONTENTS

Introduction–functions of packaging, glass packaging materials, metal packaging materials, electrolytic chromium–coated steel, aluminum, stainless steel, container making processes, paper packaging materials, plastic packaging materials. Interactions between packaging and food, aseptic packaging.

RECOMMENDED READING

Packages that Heat and Cool Themselves(2002). Aaron L. Brody, Food Technology, Products and Technologies Vol. 56, No. 7, p. 80-82.

Antimicrobial food packaging in meat industry (2002). S. Quintavalla, L. Vicini. Meat Science, 62, 373-380.

Food and drink packaging: who is complaining and who should be complaining (2002). B. Winder, K. Ridgway, A. Nelson, J. Baldwin, Applied Ergonomics, 33, 433-438.

ASSESSMENT METHODS: Written exam, Project Presentation

FQC.542 - **Trends in Food Processing-Preservation Technologies** (3 ECTS)

LECTURER: Prof. Constantinos Biliaderis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of food processing and preservation.

PREREQUISITES: Undergraduate food technology or food chemistry.

COURSE CONTENTS

Conventional and new developments in food preservation techniques in plant equipment: thermal processing, aseptic processing, microwave heating, low temperature preservation, atmosphere storage, food irradiation, high pressure processing. Quality characteristics and shelf life of foods: examples of degradation mechanisms, viscous and bakery products. Chemical changes during processing and storage of foods. Shelf life prediction. Case studies.

RECOMMENDED READING

Modified Atmosphere Packaging Technology: A Review (1995). Ivor J. Chrch and Anthony L. Parsons, J Sci Food Agric Vol. 67, p. 143-152.

Freezing processes used in the Food Industry (1993). R. M. George, Trends in Food Science & Technology, Vol. 4, p. 134-139.

Food Preservation by hurdle technology (1995). L. Leistner and L. G. M. Gorris, Vol. 6, p. 41-45.

Minimally Processed Fruits and Vegetables: Reducing Microbial Load by Nonthermal Physical Treatments (1997). Dallas G. Hoover, Food Technology, Vol. 51, No 6, p. 66-69.

Irradiation of Food (1998). Dennis G. Olson, Food Technology, Vol. 52, No 1, p. 56-62.

Non-thermal food preservation: Pulsed electric fields (1997). H. Vega-Mercado, O. Martin-Belloso, Bai-Lin Qin, Fu Jung Chang, M. Marcela Gongora-Nieto, Gustavo V. Barbosa-Canovas and B. G. Swanson, Trends in Food Science and Technology, Vol. 8, p. 151-157.

High-Pressure Processing Begins (1998). Neil H. Hermelstein, Food Technology, Vol. 52, No 6, p. 104-106.

Developments in the active packaging of foods (1999). L. Vermeiren, F. Devlieghere, M. van Beest, N. de Kruijf, J. Debevere, Trends in Food Science and Technology, Vol. 10, p. 77-86.

ASSESSMENT METHODS: Written exam

FQC.543 – **Food Product Development & Predictive Modeling of Food Quality** (3 ECTS)

LECTURER: Prof. Constantinos Biliaderis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of food product stability and shelf life assessment in relation to processing-formulation and preservation strategies adopted in food product development.

PREREQUISITES: Undergraduate food technology or food chemistry.

COURSE CONTENTS

Quality aspects & shelf life of foods: (i) Examples of quality degradation mechanisms in foods: liquid foods (fruit juices), semi-liquid and viscous food dispersions, pastry and bakery products; (ii) Chemical changes during processing and storage of foods. Nutritional bioavailability of food constituents. Modelling and prediction of quality loss and microbial growth in foods using kinetics; ASLT methodology, Time-Temperature- Indicators (TTI's) and their use in quality modeling, case studies. Principles in food product development; the R&D process of designing new products, creating prototypes and testing them.

RECOMMENDED READING

Time-Temperature Indicators. A variety of time-temperature indicators have been developed as a tool to monitor and control distribution and as a meaningful alternative to open dating (1991). Petros S. Taoukis, Bin Fu, and Theodore P. Labuza, Food Technology, p. 70-81.

Predictive Microbiology: Where are we, and where are we going? (1997). D. W. Schaffner and Theodore P. Labuza, Food Technology, Vol. 51, No. 4, p. 95-99.

Functional Foods: Their role in disease prevention and health promotion (1998). Food Technology, Vol. 52, No 11, p. 63-70.

Applications of membrane technology to food processing (1993). F. Petrus Cuperus and Herry H. Nijhuis, Trends in Food Science and Technology, Vol. 4, p. 277-282.

Quantitative evaluation of thermal processes using time-temperature integrators (1996). A. Van Loey, M. Hendrickx, S. De Cordt, T. Haentjens and P. Tobback, Trends in Food Science and Technology, Vol. 7, p. 16-25.

Extraction of secondary metabolites from plant material: A review (1996). Dick A. J. Starmans and Herry H. Nijhuis, Trends in Food Science and Technology, Vol. 7, p. 191-197.

Fundamentals of new food product development (1994). Baker, R.C., Hahn, P.W., Robbins, K.R.Elsevier B.V., Amsterdam, The Netherlands.

Sensory evaluation of food. Principles and Practises (1998). Lawless, H.T., Heymann, H. Chapman & Hall, New York, NY, USA.

Functional properties of food components (1991). Pomeranz, Y. Academic Press, Inc., San Diego, CA., USA.

Food Chemistry (1996). Fennema, O.R. Marcel Dekker, Inc., New York, NY, USA.

ASSESSMENT METHODS: Written exam

FQC.544 - **Food Legislation** (3 ECTS)

LECTURER: Asc. Prof. Maria Tsimidou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide expertise in the very subtle field of food legislation.

PREREQUISITES: Undergraduate food chemistry of food science in general.

COURSE CONTENTS

Concepts and trends in food legislation. International and federal standards: Codex alimentarious, ISO series, food safety in USA. Legislation in Europe: directives of the official journal of the EU, council regulations, food legislation in UK. Regulating methods for food analysis, case studies.

RECOMMENDED READING

EU Legislation.

FDA Legislation.

Codex Alimentarius documents.

WHO/FAO documents.

OECD documents.

International legislation (Canada, Japan etc).

ASSESSMENT METHODS: Oral Exam, Project Presentation

FQC.545 - **Products of Appellation of Origin** (3 ECTS)

LECTURER: Dr. D. Hornero-Mendez

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide expertise in food authenticity.

PREREQUISITES: Undergraduate organic chemistry or food chemistry.

COURSE CONTENTS

Olive oil, wine, honey, Mediterranean edible herbs – infusions, chemical aspects of the identity of products of appellation of origin, (geographical, botanical), chemical fingerprint, laboratory exercises.

RECOMMENDED READING

Color-pigment Correlation in Virgin Olive Oil (1991). M. Isabel Minguez-Mosquera, L. Rejano-Navarro, B. Gandul-Rojas, A. Higinio Sanchez-Gomez and J. Garrido-Fernandez, JAOCS, Vol. 68, No 5, p. 332-336.

Carotenoid Biosynthesis changes in five red pepper (Capsicum annuum L.) cultivars during ripening. Cultivar selection for breeding (2000). J. Agric. Food Chem., Vol. 48, p. 3857-3864.

Distribution of Chlorophylls and Carotenoids in ripening Olives and between oil and alperujo when processed using a two-phase extraction system (2002). JAOCS, Vol. 79, No 1, p. 1-5.

Determination of the geographical origin of Valencia orange juice using carotenoid liquid chromatographic profiles (1999). Pierre P. Mouly, Emile M. Gaydou, Josiane Corsetti, Journal of Chromatography A, Vol. 884, p. 149-159.

High-performance liquid chromatography for the characterization of carotenoids in the new sweet orange (Earlygold) grown in Florida, USA (2001). H. S. Lee, W. S. Castle, G. A. Goates, Journal of Chromatography A, 913, p. 371-377.

Profiling of colour pigments of chilli powders of different origin by high-perfomance liquid chromatography (2001). A. Kosa, T. Cserhati, E. Forgacs, H. Morais, T. Mota, A. C. Ramos, Journal of Chromatography A, 915, p. 149-154.

Formation and Transformation of Pigments during the Fruit Ripening of Capsimum annuum Cv. Bola and Agridulce (1994). M. Isabel Minguez-Mosquera and D. Hornero-Mendez, Journal of Agricultural and Food Chemistry, Vol. 42, No 1, p. 38-44.

Separation of picrocrocin, cis-trans-crocins and safranal of saffron using high-performance liquid chromatography with photodiode-array detection (1994). Petros A. Tarantilis, Moschos Polissiou, Michel Manfait, Journal of Chromatography A, 664, p. 55-61.

ASSESSMENT METHODS: Oral Exam, Project Presentation

FQC.546 - **Quality Assurance** (3 ECTS)

LECTURER: Prof. I. Arvanitoyanis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide competence in the field of quality management covering various systems of quality assurance in the food sector.

PREREQUISITES: Undergraduate food science in general and/or management.

COURSE CONTENTS

Basic concepts and principles of quality management:

The certification process, certification bodies, audit techniques. Quality assurance in laboratories, accreditation regulations & criteria, calibration and verification, calculation of uncertainty, case study.

RECOMMENDED READING

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam, Oral Exam, Project Presentation

Laboratory of Chemistry of Natural Products and Analytical Chemistry

It supports academic post–graduate training and research work in the fields of natural product analyses, isolation and identification mainly from vegetal sources as well as in the field of food chemistry. The main axes of activity are: antioxidants and applications, phytochemical analyses, essential oils, olive oil and other edible oils, wine, honey and analytical food chemistry in general, chemical fingerprinting, analyses of residual toxicants in edible substrates.

The facilities include an extended line–up of up–to–date computer assisted instrumentation: Gas Chromatograph equipped with a Flame Ionisation Detector (GC–FID) and a Nitrogen Phosphorous Detector (GC–NPD). Gas Chromatograph equipped with a Flame Ionisation Detector (GC–FID) and an Electron Capture Detector (GC–ECD). Gas Chromatograph equipped with a Flame Ionisation Detector (FID) and a Flame Photometric Detector (FPD). Gas Chromatograph coupled with a Mass Spectrometer (GC–MS (EI, CI)). High Performance Liquid Chromatograph (HPLC) equipped with a Diode Array UV–Vis Detector (DAD) and a Fluorescence Detector (FLD). Two High Performance Liquid Chromatographs (HPLC) equipped with Refractive Index Detectors (HPLC–RI). High Performance Liquid Chromatograph (HPLC) coupled with a Diode Array UV–Vis Detector and a Mass Spectrometer (ESI, APCI). Inductively Coupled Plasma (ICP) Atomic Emission Spectrophotometer. Two Diode Array UV–Visible Spectrophotometers.

In the premises are also available: RANCIMAT, Fluorescence Spectrophotometer, Differential Calorimeter, Lyophiliser, Centrifuges (up to 24.000 rpm), Deep Freeze Chamber.

The following list is an indicative menu of applied techniques.

Pesticide and industrial chemical residues: Electron captive compounds, Systematic Fungicides, Organophosphorous compounds, Triazine Herbicides, Pyrethroides, Determination of Organochlorine Pesticides in oils and fats, Determination of residues of Fenthion in olive oil, Single–step multi cartridge clean–up for Organophosphate pesticide residues. Determination in Vegetable Oil Extracts.

Water. Trihalomethanes in water, Volatile halogenated organics, Organohalide pesticides, Nitrogen and phosphorous containing pesticides.

Flavours–Essential oils. Extraction of volatile compounds from plant material, Analyses of essential oil aromatic compounds.

Fruits and Fruit Products. Organic acids in fruit juices, Carbohydrates in fruit juices, Anthocyanins in fruit juices, Ethylene in fruits, Flavour analysis.

Oils and Fats. Moisture and volatile matter, Determination of oil content in oleaginous seeds, Iodine value, Peroxide value of oils and fats, Acidity, Evidence of purity and deterioration from UV, Fatty acid methyl esters, Determination of the unsaponifiable matter, Qualitative and Quantitative determination of sterols, Determination of polar compounds in frying fats, Determination of purgeable halocarbons in olive oil, Determination of fatty acids in the 2–position in the Triglycerides, Determination of Triglycerides, Determination of Tocopherols, Determination of stigmastadienes in vegetable oils.

Antioxidants. Evaluation of antioxidant activity in foods, plant extracts and the agro industrial waste. Development of new methods for antioxidant activity tests. Isolation of natural antioxidants, elaboration of methods for eventual use in scale-up experiments.

Chemical Fingerprinting. Study of the chemical profiles of several products or plants (phenolics, sugars, volatiles, etc) and association with origin and identity. Adulteration control. Use of marker molecules to track down provenance.

MASTERS OF SCIENCE PROGRAM

Research Project (9 month duration)

Requirement

60 ECTS credits. Laboratory techniques (Related to the subject of the Master Thesis)

Research Subject Areas (topics generally available for Master of Science thesis)**:**

- Isolation, structural elucidation of various natural products.
- Antioxidants: isolation and screening for antioxidant activity.
- Added value products from cheap, renewable sources.
- Methodologies for the estimation of antioxidant activity and/or free radicals, peroxides.
- Model systems to study mechanisms of antioxidant activity.
- Toxicant residues in food.
- Chemical fingerprinting of food and drink products: authenticity, origin.
- Antifraud chemical methodologies.

Indicative master thesis realized within the area

TITLE: Model oxidation of quercetin: Isolation of two major oxidation products and evaluation of their antioxidant properties (2006)

AUTHOR: Aytac Gulsen, Food Engineer, Turkey

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTORS: Dimitrios Makris

TITLE: Testing algorithms using fatty acid methyl esters and triglyceride analyses to determine the authenticity of various vegetable oil blends (2005)

AUTHOR: Ariela Ferra, Food Chemist, Albania

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTORS: Maria Tsimidou

TITLE: Quality assessment of frying oils and HACCP safety guidelines for fried foods (2005)

AUTHOR: Mihalea-Elena Ghidurus, Industrial Biotechnology, Romania

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTOR: George Boskou

TITLE: New formulations for the production of Pasta (Lasagna) enriched with Legume protein (2004)

AUTHOR: Dimitrios Sabanis, Chemist, Greece

PLACE OF REALIZATION: Laboratory of Food Chemistry & Technology, Aristotle University of Thessaloniki, Thessaloniki, Greece

THESIS DIRECTORS: Georgios Doxastakis

TITLE: Phenolic profile and antioxidant activity of the date palm (Phoenix dactylifera) ripe fruit (2004)

AUTHOR: Abdelhak Mansouri, State Engineer in Agronomy, Algeria

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTOR: Eugenios Kokkalou

TITLE: Consumer Behaviour Analysis: The Romanian Olive oil and Honey Markets (2003)

AUTHOR: Loredana Biro, Engineer, Romania

PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTOR: Ioannis Arvanitoyannis

TITLE: Application of the HACCP System to Tahini (Sesame Cream) production at the Kanater factory in the Lebanon (2003)

AUTHOR: Fahed Ayoub, Agronomic Engineer, Lebanon

PLACE OF REALIZATION: Fanar Laboratory, Agricultural Research Institute, Fanar, Lebanon

THESIS DIRECTOR: Christo Hilan

TITLE: Pilot extraction of carotenoids from orange peel of the Valencia variety (2003)

AUTHOR: Ghada Bandak, Chemist, Palestine

PLACES OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTORS: Damaso Hornero-Mendez

TITLE: Application of peroxyoxalate chemiluminescence for the quantification of hydroxyperoxides and screening of antioxidant activity in non-aqueous media (2003)

AUTHOR: Van Stepanyan, Food Technician, Armenia

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTOR: Panagiotis Kefalas

TITLE: Sensory and trace element analysis for the classification of honey of various geographical and botanical origins (2003)

AUTHOR: Cherif Chalhoub, Chemist, Lebanon

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTORS: Nikolaos Lydaki-Symantiris, Ioannis Arvanitoyiannis

TITLE: Assessment of the antioxidant activity of virgin olive oil by DPPH free radical and Co(II)/EDTA-Induced luminol chemiluminescence methods (2003)

AUTHOR: Sinan Caner Bayramoglu, Food Engineer, Turkey

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTOR: Panagiotis Kefalas

TITLE: Determination of major anthocyanin pigments in Hellenic native grape varieties (Vitis vinifera sp.): Association with antiradical efficiency (2003)

AUTHOR: Adel Abdel-Razek Abdel-Azeem Mohdaly, Food Industries, Egypt

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTOR: Stamatina Kallithraka, Panagiotis Kefalas

TITLE: Tea and herbal infusions: their antioxidant activity and phenolic profile (2003)

AUTHOR: Ali Khalil Atoui, Agro-Nutritional Technology, Lebanon

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece

THESIS DIRECTOR: George Boskou

References of the main academic staff teaching within the M.Sc.

More than 20 invited lecturers from about 5 countries participate in each edition of the M.Sc. programme of which, 26% came from Research Institutes, 62% from Higher Education Institutions, 12% from Private Companies. Considering their implication in the programme, the following academic staff is taken as reference:

CANADA

Private companies

- Jerzy Zawistowski, Functional Foods and Neutraceuticals. Forbes Medi-Tech Inc, Vancouver

GERMANY

Research Institutes

- Joerg Degenhardt, Max Planck Institute for Chemical Ecology, Jena

GREECE

Higher Education Institutions

- Athanasios Papadopoulos, University of Crete, Rethymnon
- Antonios Calokerinos, University of Athens, Athens
- Dimitrios Boskou. Aristotle University of Thessaloniki, Thessaloniki
- Konstantinos Biliaderis, Aristotle University of Thessaloniki, Thessaloniki
- Effie Tsakalidou, Agricultural University of Athens, Athens
- Thomas Bintsis, Aristotle University of Thessaloniki, Thessaloniki
- Vassilios Roussis, University of Athens, Athens
- Evgenios Kokkalou, Aristotle University of Thessaloniki, Thessaloniki
- George Boskou, Charokopio University, Athens
- Maria Tsimidou, Aristotle University of Thessaloniki, Thessaloniki
- Ioannis Arvanitoyannis, University of Thessaly, Volos

Research Institutes

- Anastasia Detsi, Technical University of Athens, Athens
- Dimitrios Makris, National Agriculture Research Foundation, Athens

LEBANON

Higher Education Institutions

- Zeina Kassaify, American University of Beirut, Beirut

SPAIN

Research Institutes

- Damaso Hornero-Mendez, Instituto de la Grasa, CSIC, Sevilla

The Institute reserves the right to replace its visiting faculty according to its evaluation process.

Natural Products & Biotechnology

Postgraduate Specialisation and M.Sc. Programme

SCIENTIFIC COORDINATOR: **Dr. Antonios Makris**

EDUCATIONAL AND PROFESSIONAL GOALS

The Master on Natural Products and Biotechnology is a two-year programme for graduates holding a university Bachelors degree in Biology, Chemistry, Agriculture, or other related sciences.

In the first year participants follow the Postgraduate Specialization Course. The objectives of this Course are to: i) provide knowledge on the living systems producing secondary metabolites and their characteristic features; ii) introduce the current advances in the biosynthesis, characterization, and isolation of plant and microbial natural products; iii) provide extensive laboratory training in the genetic, computational and biochemical tools utilized in Natural Products Biotechnology; iv) enable a thorough scientific evaluation of the current and potential uses of natural products by the industry and the pharmaceutical sector.

Laboratory exercises combined with these courses provide a practical and tangible perspective. The qualified first year graduates are entitled of pursuing their research in an environment fully equipped with the most updated facilities.

In the second year, students who have successfully completed the first year develop a thesis based on research work and economic development study leading to a Master's of Science degree.

The scientific results of graduate studies are usually announced in International Conferences and/or published in World renowned journals.

POST GRADUATE SPECIALISATION PROGRAMME

The programme is organized in 5 sections

Section I - Introductory Discipline

The cycle includes introductory courses on Scientific English, use of Computer and Statistics..

Section II - Introduction to Advanced Biology

The cycle is devoted to Cell Biology, Molecular Biology and Biochemistry and Genetics courses. It aims to bring students from diverse scientific disciplines (Chemistry, Biology, Agriculture) on an equally high level of knowledge and address diverse issues such as genetics, biosynthesis, and biotechnology of Natural Products..

Section III - Chemistry of Natural Products

The cycle is a specialized unit in Natural Products including topic in Organic Chemistry, Biochemistry of Plant Secondary Metabolism, Chemistry and Biosynthesis of terpenoids, alkaloids, flavonoids and other phenolics, extensive laboratory in the analysis of natural products and evaluation of their role in the natural environment..

Section IV - Biotechnology of Natural Products

The cycle is a specialized unit focusing on the enzymes participating in the synthesis of Natural Products, heterologous systems of expression and large-scale production approaches..

Section V - Genomics and Proteomics of Natural Products

The cycle provides a comprehensive guide to the fascinating area of Plant Genomics and Proteomics, presenting an integrated, broadly accessible treatment of the complex relationship between the genome, transcriptome, and proteome of plants. This introduces the student to the range of molecular techniques applicable to investigating the unique facets of plant growth, development, and response to the environment, with emphasis to the applications related to plant secondary metabolism and the biosynthesis of natural products. The subject includes:

- Functional and structural genomics addressed within the context of natural products
- Current techniques and challenges to come
- How to utilize DNA and protein sequence data
- Practical considerations for choosing and employing the most commonly available computer applications
- A review of applications for biotechnology, including genetic modification and defence against pathogens
- Bioinformatics tools and Web resources
- Numerous examples from the latest research in the field of secondary metabolism and natural products.

TRAINING SEQUENCE

Section I - Introductory Discipline [4 ECTS]
from October to November

NPB.501 - Scientific English (3 ECTS)
NPB.502 - Introductory Computing (1 ECTS)

Section II - Introduction to Advanced Biology [21 ECTS]
from November to January

HOB.511 - Cell Biology (3 ECTS)
NPB.512 - Biochemistry (3 ECTS)
HOB.513 - Genetics (3 ECTS)
NPB.514 - Molecular Biology (3 ECTS)
NPB.515 - Molecular Biology Techniques (3 ECTS)
NPB.516 - Advanced Topics in Plant Cytology (3 ECTS)
NPB.517 - Tissue Culture Technology (3 ECTS)

Section III - Chemistry of Natural Products [18 ECTS]
from January to March

NPB.521 - Topics in Organic Chemistry (3 ECTS)
NPB.522 - Biochemistry of Secondary Metabolism (3 ECTS)
NPB.523 - Chemistry of Terpenoids and Essential Oils (3 ECTS)
NPB.524 - Chemistry of Alkaloids, Flavonoids and Other Phenolics (3 ECTS)
FQC.534 - Laboratory Techniques I (3 ECTS)
FQC.535 - Laboratory Techniques II (3 ECTS)

Section IV - Biotechnology of Natural Products [15 ECTS]
from March to May

NPB.531 - Enzyme Structure and Function (3 ECTS)

NPB.532 - Techniques in Biochemical Analysis (3 ECTS)
NPB.533 - Ecological and Stress Biochemistry (3 ECTS)
NPB.534 - Bioinformatics & Applications in Secondary Metabolism (3 ECTS)
NPB.535 - Industrial Biotechnology (3 ECTS)

Section V - Genomics and Proteomics of Natural Products [6 ECTS]
June

NPB.541 - Genomics and Proteomics of Natural Products I (3 ECTS)
NPB.542 - Genomics and Proteomics of Natural Products II (3 ECTS)

ANALYTICAL SYLLABUS

NPB.501 - **Scientific English** (3 ECTS)

LECTURER: Mrs Linda Lucas

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: The development of scientific writing and communication skills.

PREREQUISITES: Good knowledge in English language.

COURSE CONTENTS
Note-taking skills in order to better understand lectures; the study of scientific texts and their development; terminology related to the students' chosen field; a review of the fundamentals of English grammar with a view to studying advanced grammar skills for the purposes of writing a M.Sc. thesis; development of academic writing skills; public speaking, communication skills and theme-related discussions based on the students' chosen field of study. The final grade is awarded on the basis of the following:

- examination marks (based on grammar and scientific texts);
- presentation marks (based on oral and written presentations of students' own work);
- participation in classwork and attendance; homework assignments.

RECOMMENDED READING
Papers provided by the instructor.

ASSESSMENT METHODS: Written exam, Project Presentation

NPB.502 - **Introductory Computing** (1 ECTS)

LECTURER: Mr. Nicolas Boretos

TYPE OF COURSE AND TEACHING METHODS: Computer-assisted teaching

OBJECTIVE OF THE COURSE: Introduce scientists to the computer-based resources available.

PREREQUISITES:

COURSE CONTENTS
Computer hardware components, peripherals and controllers; architecture; operating systems. Interacting with computers. Data communications and computer networks. The Internet; brief history, protocols, addressing and domain name service(DNS). E-mail, News-Groups, Telnet, Ftp, WWW (World Wide Web). Computer applications; word processing, spread-sheets, data-bases, graphics, scientific software, schedulers. Computer Security.

RECOMMENDED READING

European Computing Driving Licence.

ASSESSMENT METHODS: Written exam, Computer-Assisted Exam

HOB.511 - **Cell Biology** (3 ECTS)

LECTURER: Dr. Constantinos Vlachonasios

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To introduce to the fundamentals of plant cell biology. To strengthen their background on biological mechanisms that takes place in the eukaryotic and prokaryotic cell. Students understand the complexity of cells and the environment where fundamental processes preserve cell homeostasis.

PREREQUISITES: Undergraduate Biology

COURSE CONTENTS

Eukaryotic versus prokaryotic cells. Cell structure and compartmentation. Cell membranes and their principles. Cell organelles and their physiology. Intracellular and intercellular communication. Genetic information storage – nucleus. Nuclear cytoplasmic interactions. Cell specialization - animal and plant cells. Cell responses to environmental stimuli.

RECOMMENDED READING

Biochemistry & Molecular Biology of Plants, B. Buchanan, W. Gruissem, R. Jones, eds. 2000, American Society of Plant Physiologist.

ASSESSMENT METHODS: Written exam

NPB.512 - **Biochemistry** (3 ECTS)

LECTURER: Prof. K. Sekeris

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To familiarise with all the important components of the chemistry of life. To introduce students to the structure and function of proteins and nucleic acids.

PREREQUISITES: Undergraduate Chemistry

COURSE CONTENTS

Water, solvent of life; Properties of solutions; buffers. Biological macromolecules; (proteins, nucleic acids, polysaccharides, lipids)

Proteins: Levels of protein organization, Protein interactions, Cell environment factors controlling protein assembly, Protein synthesis, Post-translation modifications, Protein compartmentation, Protein stability and turnover, Multiple functional stages of proteins, Multiplicity of protein forms and functions, Plant and insect hormones and their receptors

Polysacharides: Cell surface diversification, Cell adhesion, Natural products

Lipids: Simple and complex lipids, Lipoproteins, Lipid messengers

Nucleic acids: (See molecular biology)

RECOMMENDED READING

Lehninger: Chapter 3 (Biomolecules, Ch. 4 (Water), Ch. 5 (Aminoacids and peptides), Ch. 6 (An introduction to proteins), Ch. 7 (The three dimensional structure of proteins), Ch. 9 (Lipids), Ch. 11 (Carbohydrates), Ch. 12 (Nucleotides and nucleic acids) and Ch. 26 (Protein Metabolism).

ASSESSMENT METHODS: Written exam

HOB.513 - **Genetics** (3 ECTS)

LECTURER: Prof. Athanasios Tsaftaris

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide an introduction into the science of Genetics, a historical perspective and understanding of the current issues.

PREREQUISITES: Undergraduate Biology

COURSE CONTENTS

Historical perspective of Genetics. Early genetic experiments. Experimental derivation of the laws of inheritance/ Mendel. Critical experiments in the development of Genetics. Chromosome theory of inheritance. The unit of heredity. The nature of the gene; Cistrons. Position effects of DNA (Mc Clintock's work). Gene synthesis. Genetic engineering. Impact of Genetics on Society.

RECOMMENDED READING

The double Helix-50 years, Nature Publishing Group Supplement (2003) Vol. 421, p 395-453.

RNA-directed DNA methylation, (2000) M. Wassenegger, Plant Molecular Biology, 43: 203-220.

Status of genome projects for nonpathogenic bacteria and archaea, K. E. Nelson, Ian T. Paulsen, J. F. Heidelberg and C. M. Fraser (2000) Nature Biotechnology Vol. 18, 1049-1054.

Functional genomics, Nature insight, Reprinted from Vol. 405, no. 6788, 2000, p 819-822.

The Evolution of Epigenetics (2001), Science, Vol. 293, p 1063-1105.

Epigenetic Mechanisms of Gene Regulation, Edited by Vincenzo E.; A. Russo, Robert A. Martienssen and Arthur D. Riggs, p. 5-24.

Bioinformatics: A Biologist's Guide to Biocomputing and the Internet, Stuart M. Brown, Ch. 2 and Ch. 3.

DNA sequence of both chromosomes of the cholera pathogen Vibrio cholerae, J. F. Heidelberg, J. A. Elsen, W. C. Nelson, R. A. Clayton, M. L. Gwinn, R. J. Dodson, D. H. Haft, E. K. Hickey, J. D. Peterson, L. Umayam, S. R. Gill, K. E. Nelson, T. D. Read, H. Tettelin, D. Richardson, M. D. Ermolaeva, J. Vamathevan, S. Bass, H. Qin, I. Dragoi, P. Sellers, L. McDonald, T. Utterback, R. D. Fleishmann, W. G. Nierman, O. White, S. L Salzberg, H. O. Smith, R. R. Colwell, J. J. Mekalanos, J. Graig Venter and C. M. Fraser (2000), Nature Vol. 406, p. 477-483.

Molecular Cloning, A Laboratory Manual, Joseph Sambrook and David W. Russell.

The Unseen Genome: Gems among the Junk, Scientific American (2003)

The Asteroid Tugboat, R. L. Shweickart, E. T. Lu, P. Hut and C. R. Chapman (2003), Scientific American.

ASSESSMENT METHODS: Written exam

NPB.514 - **Molecular Biology** (3 ECTS)

LECTURER: Dr. Kafetzopoulos

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To familiarize with DNA science and provide an understanding of the fundamental molecular processes taking place in a cell. To introduce students to the basic steps in the flow of genetic information.

PREREQUISITES: Basic knowledge of Genetics and Biochemistry.

COURSE CONTENTS

Stereochemistry of DNA and DNA topology. DNA replication, In vitro genetics. Restriction enzymes. Transcription factors. Transcriptional machineries. Pleiotropic effects of transcription. The substrate of transcription (chromatin). Role of introns-exons. Post transcriptional regulation. Post translational regulation. Differential gene expression and chromosomal domains. Extranuclear DNA. Environmental effects of gene expression.

RECOMMENDED READING

Molecular Cell Biology, 5th Edition, Ch. 4,l Ch. 9.

ASSESSMENT METHODS: Written exam

NPB.515 - **Molecular Biology Techniques** (3 ECTS)

LECTURER: Dr. Antonios Makris

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: To familiarize in the laboratory with the basic technology of recombinant DNA work.

PREREQUISITES: Basic knowledge of molecular biology.

COURSE CONTENTS

Aseptic techniques; media preparation; Subculturing of bacteria, dilution, replica plating, storage; Bacterial transformation with plasmids. Chemical transformation; electroporation; Isolation of plasmid DNA; digestion of plasmid DNA; Agarose gel electrophoresis extraction of DNA from gel; Plant DNA extraction, techniques and problems; DNA hybridisation using radioactive probes, PCR, methodologies.

RECOMMENDED READING

Molecular Cloning, A Laboratory Manual, 3rd Edition, Joseph Sambrook and David W. Russell, Ch. 1, 2, 5 and 8.

Molecular Biology of the Cell, 4th Edition, Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, Ch. 7.

ASSESSMENT METHODS: Written exam

NPB.516 - **Advanced Topics in Plant Cytology** (3 ECTS)

LECTURER: Prof. Artemios Bozabalidis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: An in depth understanding of the ultrastructure of a plant cell.

PREREQUISITES: Basic knowledge of cell biology.

COURSE CONTENTS

The compartmentation of the plant cell. Morphometric assessment of the cell structural elements. The biomembrane (fluid mosaic, active transport, fusion, potential, endo/exocytosis). The cytoskeleton (microtubules, actin filaments, intermediate filaments). Ribosomes and protein synthesis. The endomembrane system (fine structure of the Golgi apparatus and the endoplasmic reticulum, transport of glycoproteins, dynamic membrane flow, microbodies with specific functional activities). Organization of the interphase nucleus, cell division. Structural composition of the cell fundamental energy centers (mitochondria) and their implication in the process of respiration. Types of plastids and their participation in specific intracellular procedures. Fine structure of the chloroplasts in regards to the course of photosyntesis. The vacuoles as osmotic, depository and lytic sites of the plant cell. The cell wall (membrane rosettes and genesis of cellulose microfibrils, the sceletic lattice, mechanism of microfibril orientation, thickening of the cell wall, plasmodesmata, functional activities).

RECOMMENDED READING

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam

NPB.517 - **Tissue Culture Technology** (3 ECTS)

LECTURER: Prof. Dimitrios Voyatzis, Mr. Nikolaos Leventakis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: To provide a theoretical and practical perspective of plant tissue and plant propagation methodologies.

PREREQUISITES: Knowledge of plant physiology and cell biology.

COURSE CONTENTS

Aseptic techniques, Media preparation, Callus induction, Plant regeneration, Cell suspension cultures. Seed production procedures. Production and propagation material in of vegetatively propagated crops. Use of tissue culture and transformation in plant propagation and genetic engineering. Genetic engineering in plant breeding. Genetic improvement of vegetatively propagated crops.

RECOMMENDED READING

Plant Propagation (Conventional, Micropropagation, Genetic Engineering), Principles and Applications, Demetrios G. Voyiatzis (2003).

Plant Propagation by Tissue Culture, K. Grigoriadou and N. Leventakis.

ASSESSMENT METHODS: Written exam, Quiz

NPB.521 - **Topics in Organic Chemistry** (3 ECTS)

LECTURER: Dr. Elias Couladouros

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: This course aims to provide students coming from a wide range of disciplines (biology, agriculture, microbiology, biochemistry, physiology) with a comprehensive understanding of the basic concenpts of organic chemistry.

PREREQUISITES: Undergraduate Chemistry

COURSE CONTENTS

The course is designed to introduce the students to the principles of organic reactions and reaction mechanisms particular to the synthesis and analysis of natural products. The rational design and synthesis of novel compounds with desired properties based on natural products and the application of combinatorial chemistry are other aspects of this course.

RECOMMENDED READING

Organic Chemistry, John McMurry, 5th Edition, Ch. 1, Ch. 2, Ch. 3, Ch. 4, Ch. 5, Ch. 6, Ch. 9, Ch. 15.

ASSESSMENT METHODS: Written exam

NPB.522 - **Biochemistry of Secondary Metabolism** (3 ECTS)

LECTURER: Dr. Joerg Degenhardt

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: A thorough overview of plant secondary metabolism.

PREREQUISITES: Good knowledge in Organic Chemistry, Biochemistry, Molecular Biology, and Plant Physiology.

COURSE CONTENTS

Introduction to plant metabolism. Plant structure and cell structure. Chemical nomenclature, the logic of metabolism and reaction mechanisms. Building blocks-biosynthetic pathways. Shikimate,

mevalonate, methylerythritol phosphate pathway, glyceraldehyde-3-phospate/ pyruvic acid pathway.

Important secondary metabolite groups: Fatty acids and polyketides, phenylpropanoids and lignin, terpenoids and steroids, tropane alkaloids, terpenoid indole alkaloids.

Gene regulation in secondary metabolism. Tissue specificity (phenylpropanoids) and stress responsiveness (terpenoid indole alkaloids). Compartmentation, storage and transport.

RECOMMENDED READING

Biochemistry & Molecular Biology of Plants, Buchanan, Gruissem and Jones, Ch. 24.
Plant Physiology, 2nd Edition, Taiz and Zeiger, Ch. 13.
Power Point Presentation.

ASSESSMENT METHODS: Written exam

NPB.523 - **Chemistry of Terpenoids and Essential Oils** (3 ECTS)

LECTURER: Ass. Prof. Vassilios Roussis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of fragrance and flavour through the prism of chemistry and industrial approach.

PREREQUISITES: Organic Chemistry.

COURSE CONTENTS

Fragrance and flavouring compounds : essential oils, terpenoids-oleoresins- Detailed biochemical pathways for the production of volatile compounds in specific plant species; Chemical structure, distribution, diurnal and seasonal fluctuations; Infraspecific differences in volatiles oil production, differentiation between geographical origins; Turpentine and terpene industry and, biological activity).Raison d'être.

RECOMMENDED READING

Methods in Plant Biochemistry, 1991, Barry V. Charlwood and Derek V. Banthorpe, Vol. 7, Ch. 1, Ch. 4 and Ch. 5.

ASSESSMENT METHODS: Written exam

NPB.524 - **Chemistry of Alkaloids, Flavonoids and Other Phenolics** (3 ECTS)

LECTURER: Ass. Prof. E. Kokkalou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced notions of the chemistry and pharmacology of various natural products.

PREREQUISITES: Organic Chemistry

COURSE CONTENTS

Pharmacological action of alkaloids : Pyridine-piperidine alkaloids, Tropane alkaloids, quinoline alkaloids, isoquinoline alkaloids, indole alkaloids, imidazole alkaloids, steroidal alkaloids. Detailed biochemical pathways for the production of alkaloids in specific plant species. Chemical structures, subcellular localization, distribution and evolution in gymnosperms and angiosperms, biological activity & role of alkaloids in plants. Detailed biochemical pathways for the production of flavonoids in specific plant species. Chemical structures, subcellular localization, natural distribution and evolution in gymnosperms and angiosperms. Biological activity: role of flavonoids in plants, Natural

pigments:anthocyanins-flavonoids-other phenolic compounds and other miscellaneous natural pigments.

RECOMMENDED READING

The Systematic Identification of Flavonoids, 1970, Marby and Thomas Markham, Published by Springer Vertag.

ASSESSMENT METHODS: Written exam

FQC.534 - **Laboratory Techniques I** (3 ECTS)

LECTURER: Dr. Anastasia Detsi

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: To provide knowledge and know how over techniques and methodologies applied in chemical laboratories for food and natural products.

PREREQUISITES: Undergraduate organic chemistry or undergraduate analytical chemistry.

COURSE CONTENTS

Theory of chromatography, instrumental techniques (GC, HPLC) and applications, principles of mass spectroscopy and applications (LC-MS, GC-MS), principles of photospectroscopy, other spectroscopic methods (IR, NMR), identification, quantitation, structural determination, laboratory exercises.

RECOMMENDED READING

Power Point Presentation.

ASSESSMENT METHODS: Written exam

FQC.535 - **Laboratory Techniques II** (3 ECTS)

LECTURER: Dr. Dimitrios Makris

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: As continuation of "Laboratory techniques I", the course provides knowledge and know how over techniques and methodologies applied in chemical laboratories for food and natural products.

PREREQUISITES: Undergraduate organic chemistry or undergraduate analytical chemistry.

COURSE CONTENTS

Theory of chromatography, instrumental techniques (GC, HPLC) and applications, principles of mass spectroscopy and applications (LC-MS, GC-MS), principles of photospectroscopy, other spectroscopic methods (IR, NMR), identification, quantitation, structural determination, laboratory exercises.

RECOMMENDED READING

Laboratory Techniques, Dimitris Makris, Ph.D. AMRSC, 2005

ASSESSMENT METHODS: Written exam

NPB.531 - **Enzyme Structure and Function** (3 ECTS)

LECTURER: Dr. Sotirios Kampranis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To familiarize with the world of enzymes and the mechanisms of catalysis.

PREREQUISITES: Good knowledge of Biochemistry.

COURSE CONTENTS

Enzymes are fundamental to all life. Without proteinaceous catalysts the chemistry of life would simply not occur. They are supremely efficient catalysts and are capable of exquisite feats of molecular recognition. They are responsible for the biosynthesis of natural products and they form the molecular targets of compounds with pharmacological properties. For these reasons they are of prime importance to the biotechnology of natural products. Moreover, much of modern biotechnology is involved with the production and use of proteins. Enzymes, not only are important to the pharamaceutical industry, but also are relevant to food and plant biotechnology. To the former, they are sources of novel functionality in the complex systems that make up food, whilst to the latter, they are the target of rational strategies to redesign the properties of crop plants. This module is aimed at students with a range of backgrounds and is designed to provide the knowledge base and intellectual framework for more advanced studies of particular relevance to Natural Products and Biotechnology.

RECOMMENDED READING

Fundamentals of Enzyme Kinetics, Athel Cornish-Bowden, Portland Press Ltd, ISBN: 1855781581.

Enzyme Kinetics: Behavior and Analysis of Rapid Equilibrium and Steady-State Enzyme Systems (Wiley Classics Library), ~Irwin H. Segel, John Wiley & Sons Inc. ISBN: 0471303097.

DNA Topology, ~A. Bates, Tony Maxwell, Oxford University Press, ISBN: 019856709X.

Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, ~Irwin Harvey Segel, John Wiley and Sons (WIE), ISBN: 0471774219.

Introduction to Protein Structure, ~Carl Branden, John Tooze, Garland Science, ISBN: 0815323050.

DNA-protein Interactions: A Practical Approach (Practical Approach S.), ~Andrew Travers (Editor), Malcolm Buckle (Editor), Oxford University Press, ISBN: 0199636923.

ASSESSMENT METHODS: Written exam

NPB.532 - **Techniques in Biochemical Analysis** (3 ECTS)

LECTURER: Dr. Sotirios Kampranis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory, Computer-assisted teaching

OBJECTIVE OF THE COURSE: To provide a hands-on approach into the basic techniques of protein expression and purification.

PREREQUISITES: Good knowledge of Biochemistry, Enzymology.

COURSE CONTENTS

This laboratory-based course covers the basic techniques of protein expression, purification and characterisation. These include: Production of recombinant proteins in bacteria, cell lysis, gel-filtration chromatography, ion-exchange chromatography, affinity chromatography, hydrophobic interaction chromatography, SDS-PAGE, isoelectric focusing, Western blotting, determination of protein concentration and enzyme activity assays.

RECOMMENDED READING

Molecular Cloning (3-volume set), ~Joe Sambrook, David Russell, Cold Spring Harbor Laboratory Press, ISBN: 0879695773.

Protein Purification Techniques: A Practical Approach (Practical Approach S.), ~E.L.V. Harris (Editor), et al., Oxford University Press, ISBN: 0199636737.

Protein-ligand Interactions: A Practical Approach: Structure and Spectroscopy (Practical Approach S.),~S.E. Harding (Editor), B. Chowdhry (Editor), Oxford University Press, ISBN: 0199637474.

Protein Structure Prediction: A Practical Approach (Practical Approach S.), ~Michael J.E. Sternberg (Editor), Oxford University Press, ISBN: 0199634963.

Protein Purification Applications: A Practical Approach (Practical Approach S.), ~E.L.V. Harris (Editor), et al., Oxford University Press, ISBN: 0199636710.

ASSESSMENT METHODS: Written exam

NPB.533 - **Ecological and Stress Biochemistry** (3 ECTS)

LECTURER: Dr. Christopher Johnson

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide an in-depth perspective of the interactions between plants and their environment and the ecological role of secondary metabolism.

PREREQUISITES: Knowledge in Plant Physiology.

COURSE CONTENTS

Biosynthesis of secondary compounds in plants. Control mechanisms; biochemistry and molecular basis. Ecological role of plant secondary metabolites. Biochemistry of plant pollination (flower colour, flower scent). The role of secondary compounds in plant-pollinator interactions. The role of secondary compounds in plant-herbivore interactions (insects, vertebrates, fungi). Plant toxins and their effects on animals (cyanogenic glycosides, cardiac glycosides), The cost of resistance to herbivores. Animal pheromones and defence substances (insect pheromones, mammalian pheromones, defence substances). Effects of higher plants on micro-organisms mediated by plant secondary compounds (Phytoalexins, Phytotoxins), plant-plant biochemical interactions (inhibition of seed germination, allellopathy). Environmental and genetic control of nitrogen assimilation in relation to secondary metabolism.

RECOMMENDED READING

Plant Physiology, 2nd Edition, Teiz and Zeiger, Ch. 13, Ch. 17.

Introduction to Ecological Biochemistry, J. B. Harborne, Ch. 1, Ch. 2, Ch. 3, Ch. 7.

ASSESSMENT METHODS: Written exam

NPB.534 - **Bioinformatics & Applications in Secondary Metabolism** (3 ECTS)

LECTURER: Dr. Panagiotis Kanellopoulos

TYPE OF COURSE AND TEACHING METHODS: Computer-assisted teaching

OBJECTIVE OF THE COURSE: The course aims to introduce the basic tools used in computational biology for analyzing genes, proteins and metabolic pathways.

PREREQUISITES: Knowledge in Molecular Biology and Biochemistry.

COURSE CONTENTS

The topics include: Introduction to the GenBank sequence database; Structure databases; Information retrieval from biological databases; tools for DNA sequence analysis, multiple sequence alignment; tools for protein analysis, protein linkage-maps; constructing phylogenetic trees; Introduction to metabolic pathways; mining data for understanding secondary metabolism.The course is inclusive of all the modern approaches that enable scientists to establish genetic relationships, construct phylogenetic trees, dissect secondary metabolic pathways and understand basic concepts of structure-function relationships of the enzymes involved in secondary products formation.

RECOMMENDED READING

Vector NTI Suite, Application Program, Molecular Biology Software, PC, MAC.

Bioinformatics: A practical guide to the analysis of genes and proteins, 1998, A. D. Baxevanis, B. F. Francis Ouellette.

ASSESSMENT METHODS: Written exam, Computer-Assisted Exam

NPB.535 - **Industrial Biotechnology** (3 ECTS)

LECTURER: Prof. Dimitrios Kyriakidis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: This course is designed to familiarise the students with the methods used to produce compounds of high commercial value in the Biotechnological Industry.

PREREQUISITES: Knowledge in Biochemistry and Molecular Biology.

COURSE CONTENTS

The course will cover the following topics: Bioprocessing (Microorganisms with biotechnological interest, Bioreactors for microorganisms, Criteria of biotechnological processes), Industrial applications of recombinant technology, Purification of proteins (recombinant, membrane-bound, antibodies, pharmaceutical proteins etc), Protein engineering of enzymes with biotechnological interest, Regulatory mechanisms of biosynthetic enzymes (Metabolic engineering), Immobilization of enzymes, coenzymes and cells, Downstream processing, Sterilization, Bioreactors (Types of Bioreactors, Designing of Bioreactors, Enzymes for Bioreactors), Examples of Biotechnological processes (Production of pharmaceutical proteins and vaccines, Production of polysaccharides and aromatic compounds, Production of biodegadative polymers, Monoclonal Antibodies, Other biotechnological applications).

RECOMMENDED READING

Industrial Biotechnology, Prof. D. Kyriakidis, provided by he instructor.

ASSESSMENT METHODS: Written exam

NPB.541 - **Genomics and Proteomics of Natural Products I** (3 ECTS)

LECTURER: Dr. Sotirios Kampranis, Dr. Nikolaos Panopoulos, Dr. Kriton Kalantidis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: A two course unit composed of advanced series of seminars on the genomics and proteomics approaches in secondary metabolism.

PREREQUISITES: Molecular Biology and Biochemistry.

COURSE CONTENTS

- Functional and structural genomics addressed within the context of natural products
- Current techniques and challenges to come
- RNA interference: Concepts and applications in plant biology
- Agrobacterium transformation concepts and uses
- A review of applications for biotechnology, including genetic modification and defence against pathogens
- Mechanisms of signal transduction in plants for disease resistance
- FPLC protein purification

RECOMMENDED READING

Dr. N. Panopoulos, The Plant Cell.

Dr. Kriton Kalantidis, Gene silencing as an adaptive defence against viruses (2001). Peter M. Waterhouse, Ming-Bo Wang and Tony Lough, Nature, Vol 411, p. 834-842.

Post-transcriptional gene silencing in plants (2001). H. Vaucheret, Ch. Beclin and M. Fagard, Journal of Cell Science 114, 3083-3091.

On the role of RNA amplification in dsRNA-Triggered gene silencing (2001). Cell, Vol. 1074, 465-476.

Exploring Plant genomes by RNA-Induced gene silencing. Peter M. Waterhouse and Christopher A. Helliwell. Nature. http//www.nature.com/cgi-taf/DynaPage.taf?file=/nrg/journal/v4/n1/full/nrg982_r.html.

Power point presentation.

ASSESSMENT METHODS: Written exam

NPB.542 - **Genomics and Proteomics of Natural Products II** (3 ECTS)

LECTURER: Prof. Paul Christou

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: A two course unit composed of advanced series of seminars on the genomics and proteomics approaches in secondary metabolism.

PREREQUISITES: Molecular Biology and Biochemistry.

COURSE CONTENTS

- Applied Plant Biotechnology: An overview
- World Agricultural production: current situation, prospects and challenges
- The legal framework in plant Biotechnology
- Plant Biotechnology for Natural Products

RECOMMENDED READING

Between myth and reality: genetically modified maize, an example of a sizeable scientific controversy (2002). Jean-Pierre Wisniewski, Nathalie Frangne, Agnes Massonneau, Christian Dumas, Biochimie 84, p. 1095-1103.

The science and politics of plant biotechnology – a personal perspective (2003). Nature Biotechnology, Vol. 21, no 8, p. 849-851.

No credible scientific evidence is presented to support claims that transgenic DNA was introgressed into traditional maize landraces in Oaxaca, Mexiko. Paul Christou, Transgenic Research 11: iii-v 2002.

Transgenic Maize and the Evolution of Landrace Diversity in Mexico. The importance of Farmer's Behavior (2004). Mauricio R. Bellon and Julien Berthaud, Plant Physiology Vol. 134, p. 883-888.

How should Society Approach the real and Potential risks posed by new technologies? (2003). Carl F. Cranon, Plant Physiology, Vol. 133, p. 3-9.

Power Point presentation

ASSESSMENT METHODS: Written exam

Laboratory of Plant Molecular Biology and Biochemistry

The laboratory of Plant Molecular Biology and Biochemistry aims to provide the necessary facilities and molecular tools to meet the research and training needs of the department of Natural Products & Biotechnology.

The ongoing research activities taking place in the laboratory include:

Research topics on biochemistry and molecular biology, tissue culture and plant physiology.

Selection, genetic and chemical characterisation, and breeding of Medicinal and Aromatic plants.

Manipulation and Genetic engineering of plant secondary metabolism.

Isolation and Characterisation of plant components involved in resistance to environmental stress and Programmed Cell Death.

The facility includes an extended line–up of up–to–date computer–assisted apparatae, including: Fast Protein Liquid Chromatography (FPLC), Capillary Electrophoresis, Gas chromatography (GC), HPLC coupled to Electrospray Mass–Spectrometer (ES/MS); HPLC with Diode–Array Detector (DAD) and Refractive Index Detector (RID), Diode-array UV–Visible Spectrophotometer, Fluorescence Spectrophotometer, ELISA Plate Reader, 2 PCR Thermo–cyclers, 2 Centrifuges (up to 24,000 rpm), Bench–top Centrifuges (up to 6,000 rpm), microcentrifuges, DNA and protein Electrophoresis Apparatae, 2–Dimensional Protein Electrophoresis Apparatus, Isoelectric Focusing (IEF) Apparatus, Electroporation Apparatus, Sonicator, Shaking Incubators, Microscopes linked to digital camera, Laminar Flow, Gel Documentation System, Autoclave, Lyophiliser, LI–COR 6400 Portable Photosynthesis meter, Controlled Environment Chambers, Deep Freeze Chambers (-70°C), Cold Rooms (4°C), Tissue Culture Room, Growth Room, Radioactive Work Room, Photo dark room.

The Laboratory also includes a state of the art: **Microbiological Safety Room**

Isolated biological safety room, equipped with a Heraeus HS-15 class-II biological safety cabinet. Designated area for microbiological analysis of pathogenic microorganisms and tissue culture.

MASTERS OF SCIENCE PROGRAM

Research Project (9 month duration)

Requirement
60 ECTS credits

Laboratory techniques (Related to the subject of the Master Thesis)

Research Subject Areas (topics generally available for Master of Science thesis)**:**

- Isolation and characterisation of the components of the cellular machinery involved in the biosynthesis of natural products (terpenoids, flavonoids etc.).
- Biotechnological production of natural products by the means of in vitro (bio-reactor) or in vivo (cell factory) reconstition of the biosynthetic pathway.
- Manipulation and genetic engineering of plant secondary metabolism to yield plants with improved production characteristics.
- Engineering of plant resistance to biotic (pathogen) and abiotic (drought, chill) stress through manipulation of the secondary metabolism

Indicative master thesis realized within the area

TITLE: Novel developments in luminal chemiluminescene: Application of the luminal/Co(II)-EDTA and luminal/hemin systems on oils (2006)

AUTHOR: Siham Bezzi, Algeria

PLACE OF REALIZATION: Department of Food Quality Management and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Anthony C. Calokerinos, Panagiotis Kefalas

TITLE: Studies on the biological and biochemical properties of a *Salvia fruticosa* isoflavone reductase homologue (2005)

AUTHOR: Mohamed Abd El Ghani Ali El Sayed, Egypt

PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Antonios Makris, Sotirios Kampranis

TITLE: Functional expression in-vitro and biochemical characterization of terpene synthases of *Salvia fruticosa* (2005)

AUTHOR: Samir Anssour, Algeria

PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Christopher Johnson, Sotirios Kampranis

TITLE: Transposon tagging in yeast to identify genes involved in resistance to bax lethality (2005)

AUTHOR: Samer Matta, Lebanon

PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Antonios Makris

TITLE: Environmental and ontogenic variation of terpene biosynthesis (2005)

AUTHOR: Mohamed Sadok Ennaifer, Tunisia

PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Christopher Johnson

TITLE: Differential roles of glutathione S-Transferases in oxidative stress (2005)

AUTHOR: Nicolas Clatot, France

PLACE OF REALIZATION: Department of Natural Products & Biotechnology

THESIS DIRECTOR: Sotirios Kampranis

TITLE: Flavonoid composition of Greek honey. Qualitative and quantitative variation among pine honey samples from different geographical areas of Greece (2005)

AUTHOR: Farid Aboud, Algeria

PLACE OF REALIZATION: Department of Food Quality Management and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Panagiotis Kefalas

TITLE: Chemical investigation of the volatile metabolites of species of the genus *Rosa* growing in the Lebanon (2005)

AUTHOR: Dominique Choueiter, Lebanon

PLACE OF REALIZATION: Department of Food Quality Management and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Vassilios Roussis

TITLE: A study on the antioxidant properties of Mediterranean algae: preliminary chemical investigation of the sea grass *Posidonia oceanica* (2005)

AUTHOR: Raluca Alexandra Stoiculescu, Romania

PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Vassilios Roussis

TITLE: Sonochemical degradation of the Olive-oil wastewater phenolics monitored by Co(II)EDTA-Induced luminol chemiluminescence (2004)

AUTHOR: Dora Atanasova, Bulgaria

PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTORS: Antonios Calokerinos, Elefteria Psillakis

TITLE: Functional studies of Jemma and Emsy proteins (2003)

AUTHOR: Taha El-Metwali Ahmed El-Metwali, Chemist, Egypt

PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Sotirios Kampranis

TITLE: Elaboration of extraction methods from the orange peel for fingerprinting and in view of obtaining natural pigments for use in the industry as added value natural products (2003)

AUTHOR: Dani Georges Fadel, Lebanon

PLACE OF REALIZATION: Department of Food Quality Mangement & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Damaso Hornero Mendez

TITLE: Establishing genetic models in yeast for dissecting program cell death processes in Eukaryotes (2003)

AUTHOR: Soumaya Belhocine, Algeria

PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Antonios Makris

TITLE: Isolation of yeast genes restoring sensitivity to Bax tolerant mutants (Bax lethality in yeast affects the vacuoles in addition to mitochondria in a distinct manner) (2003)

AUTHOR: Cecilia Mbithe Mweu, Kenya

PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

THESIS DIRECTOR: Antonios Makris

References of the main academic staff teaching within the M.Sc.

More than 25 invited lecturers from about 4 countries participate in each edition of the M.Sc. programme of which, 20% came from Research Institutes, 74% from Higher Education Institutions, 6% from Private Companies. Considering their implication in the programme, the following academic staff is taken as reference:

GERMANY

Research Institutes

- Joerg Degenhardt. Max Planck Institute for Chemical Ecology, Jena

Higher Educational Institutions

- Dr. Rainer Fischer. University of Aachen, Aachen

GREECE

Higher Education Institutions

- Konstantinos Vlachonasios. Aristotle University of Thessaloniki, Thessaloniki
- Athanasios Tsaftaris. Aristotle University of Thessaloniki, Thessaloniki
- Dimitrios Voyatzis, Aristotle University of Thessaloniki, Thessaloniki
- Artemios Bozabalidis. Aristotle University of Thessaloniki, Thessaloniki
- Elias Couladouros. Agricultural University of Athens, Athens
- Vassilios Roussis. University of Athens, Athens
- Eugenios Kokkalou. Aristotle University of Thessaloniki, Thessaloniki
- Dimitrios Kyriakidis. Aristotle University of Thessaloniki, Thessaloniki

Research Institutes

- K. Sekeris. National Research Institute, Athens
- Dimitrios Kafetzopoulos. Institute of Molecular Biology and Biotechnology, Heraklion
- Panagiotis Kanellopoulos, Laikon Hospital, Biochemistry Laboratory, Athens
- Anastasia Detsi. Institute of Organic and Pharmaceutical Chemistry, Athens
- D. Tzamarias. Institute of Molecular Biology and Biotechnology, Heraklion
- Nikolaos Panopoulos. Institute of Molecular Biology and Biotechnology, Heraklion
- Kriton Kalantidis. Institute of Molecular Biology and Biotechnology, Heraklion

Private Companies

- Nikolaos Leventakis. In Vitro Hellas, Imathia

SPAIN

Higher Education Institutions

- Paul Christou, University of Lleida, Lleida

THE NETHERLANDS

Research Institutes

- Andy Pereira, Centre For Plant Breeding and Reproduction Research, Wageningen

UNITED KINGDOM

Higher Education Institutions

- Christopher Johnson, University of Reading, Reading

UNITED STATES

Higher Education Institutions

- E. Moudrianakis, John Hopkins University
- John Scandalios, North Carolina State University, Raleigh

The Institute reserves the right to replace its visiting faculty according to its evaluation process.

Sustainable Agriculture

Postgraduate Specialisation and M.Sc. Programme

SCIENTIFIC COORDINATOR: **Dr. Ioannis Livieratos**

EDUCATIONAL AND PROFESSIONAL GOALS

- To introduce the frame of the legal requirements and the methodological approach to certification systems of environmental friendly, sustainable and safe agrofood production.
- To specify the requirements of sustainability within the context of the new Common Agricultural Policy and the application of the quantitative methods for measuring the effect of sustainable production to environment.
- To provide the agronomic knowledge of assessing the impact of the biotic and abiotic production inputs to sustainable production systems.
- To present modern recycled soiless greenhouse production methods and their application to sustainable horticultural production.
- To emphasise on case studies in organic and integrated production management of various horticultural crops.

The program has a duration of 2 years and is mainly addressed to graduates of Agricultural Engineering, or other related field. Students who have successfully completed the first year with an average above 70% develop a thesis in the second year based on research work leading to a Master's of Science degree. The scientific results of the research thesis are usually announced in International Conferences and/or published in World Renowned Journals.

POST GRADUATE SPECIALISATION PROGRAMME

The programme is organized in 8 sections

Section I - Introductory Discipline

The Cycle includes introductory courses on Scientific English and use of Computer.

Section II - Biometrics

Most plant improvement programs in agricultural research involve experiments in which data are collected on genotype response across environments. Scientists must extract pertinent information from these data to make timely decisions on genotype recommendation, release or selection and on site selection for subsequent trials. The role of biometry in advancing knowledge in experimental design, analysis and interpretation of such data is of direct relevance to the economic viability of most rural industries. This cycles is devoted to the design of field experiments and the investigation of genotype environment interactions for primary economic plant attributes (yield and quality).

Section III - Introduction to Sustainability

This cycle is an introductory overview to sustainability. It is a thorough presentation of the ecological aspects of sustainability, the toxic effects of chemicals to the environment, the environmental indicators and how they are used to measure impact to the environment, analysis of sustainable, organic farming systems and finally precision agriculture. The last course in this module, the pertinent legislation used to certify quality assurance is presented.

Section IV – Natural Resources Management

This cycle deals with the basic aspects of soil science and water management and how these resources can be used in a sustainable way. Soil properties and processes, soil as related to the environment and soil degradation problems and solutions. The water management course will emphasize water balance of agricultural lands, agricultural water use efficiency and sustainable on-farm irrigation.

Section V – Assessment of Genetic Resources

Modern agriculture has a significant impact on agrobiodiversity. Equally, loss of biodiversity can have significant impacts on agroecosystems. Ways to measure and manage agrobiodiversity are essential tools of a sustainable agroecosystem. An important element of biodiversity conservation is the seed storage technology in seed banks. This technology requires knowledge on seed biology and seed germination and viability testing. Alternative technologies exist for germplasm that cannot be conserved with seeds such as recent advances in tissue culture and cryopreservation of vegetative material.

Section VI – Crop Protection

This cycle is devoted to plant pest (fungi and bacteria, viruses, insects) and weeds management. Basic principles and techniques of integrated pest and weed management will be presented. Selected biotechnological advances on crop protection will be presented.

Section VII – Greenhouse Management

This is a module on greenhouse management and hydroponic systems. The first part emphasizes greenhouse structures, environment and equipment for climate control. In addition, topics on energy saving technologies and renewable resources will also be covered extensively. The soilless culture course will cover hydroponic systems, their equipment, and water and nutrient management. Finally, disinfection strategies will be also introduced. Complementary to this topic is the subject of how the microclimate can influence crop growth and how the growth pattern can be assessed using computation and modeling. The bioclimatology course will focus on energy balance and plant responses to environmental factors while the crop modeling topics will emphasize how and why is used as a tool and present several case studies.

Section VIII – Case Studies on Integrated and Organic Farming Systems

Case studies focused on the following crops will be presented: olives, grapes, citrus and vegetables.

TRAINING SEQUENCE

Section I - Introductory Discipline [4 ECTS]
from October to November

SAG.511 - Scientific English (3 ECTS)

SAG.512 - Introduction to Computers (1 ECTS)

Section II - Biometrics [3 ECTS]
October

SAG.521 - Crop Experimentation (3 ECTS)

Section III - Introduction to Sustainability [12 ECTS]
November-December

SAG.531 – Agro-Ecosystems and Population Dynamics (3 ECTS)

SAG.532 – Ecotoxicology (3 ECTS)

SAG.533 – Agro-Environmental Impact Assessment and Farm Management (3 ECTS)

SAG.534 – Quality Assurance & Good Agriculture Practice (3 ECTS)

Section IV – Natural Resources Management [9 ECTS]
January

SAG.541 – Soil Properties and Quality Assessment (2 ECTS)

SAG.542 – Compost Technology (1 ECTS)

SAG.543 – Nutrient Management and Soil Fertility Improvement (3 ECTS)

SAG.544 – Optimal Water Use (3 ECTS)

Section V – Assessment of Genetic Resources [9 ECTS]
February

SAG.551 – Agrobiodiversity (3 ECTS)

SAG.552 - Seed Production and Quality Management (2 ECTS)

SAG.553 – Plant Breeding (1 ECTS)

SAG.554 – Biotechnological Approaches to Plant Propagation (3 ECTS)

Section VI – Crop Protection [18 ECTS]
March-April

SAG.561 – Plant/Pest interactions & Integrated Pest Management (3 ECTS)

SAG.562 – Fungal and Bacterial Disease Management (3 ECTS)

SAG.563 – Detection and Epidemiology of Plant Virus Diseases (3 ECTS)

SAG.564 – Insect Management (3 ECTS)

SAG.565 - Weed Management ((3 ECTS)

SAG.566 – Biotechnological Approaches to Crop Protection (3 ECTS)

Section VII - Greenhouse Management [9 ECTS]
May

SAG.571 – Crop Modeling and Bioclimatology (3 ECTS)

SAG.572 - Greenhouse Technology and Climate Control (3 ECTS)

SAG.573 - Soilless Culture (3 ECTS)

Section VIII – Integrated & Organic Farming
June

SAG.VIII – Case Studies in Organic and Integrated Production (olive trees, vegetables, citrus trees, grapevine)

COMPREHENSIVE ORAL OR WRITTEN EXAMINATION (MODALITIES AND DATES)

During Section 1, participants attend classes on English TOEFL and Introduction to Computers. They are also obliged to attend a 45-hour course in Scientific English, equally distributed during Sections 1 – 5, and take a written examination.

Participants take written examinations or submit projects for every unit within one cycle in the exam week, which is scheduled at the end of every cycle, each unit being independently graded. Written exams consist of a set of questions that require a concise answer. Some of the questions are multiple choice. Lengthy questions are avoided. A comprehensive oral examination conducted by an Examination Board takes place at the end of the academic year, representing 15% of the total grade. Participants may retake once failed exams of sections 1, 2, 3, 4, 5, 6 and 7.

ANALYTICAL SYLLABUS

SAG.511 - **Scientific English** (3 ECTS)

LECTURER: M. Verivaki

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: The development of scientific writing and communication skills.

PREREQUISITES: Good knowledge in English language.

COURSE CONTENTS

Note-taking skills in order to better understand lectures; the study of scientific texts and their development; terminology related to the students' chosen field; a review of the fundamentals of English grammar with a view to studying advanced grammar skills for the purposes of writing a M.Sc. thesis; development of academic writing skills; public speaking, communication skills and theme-related discussions based on the students chosen field of study. The final grade is awarded on the basis of the following:

- examination marks (based on grammar and scientific texts);
- presentation marks (based on oral and written presentations of students' own work);
- participation in classwork and attendance; homework assignments.

RECOMMENDED READING

Papers provided by the instructor.

ASSESSMENT METHODS: Written exam

SAG.512 - **Introduction to Computers** (1 ECTS)

LECTURER: N. Boretos

TYPE OF COURSE AND TEACHING METHODS: Computer-assisted teaching

OBJECTIVE OF THE COURSE: Introduce scientists to the computer-based resources available.

PREREQUISITES:

COURSE CONTENTS

Computer hardware components, peripherals and controllers; architecture; operating systems. Interacting with computers. Data communications and computer networks. The Internet; brief history, protocols, addressing and domain name service 9DNA). E-mail , News-Groups, Telnet, Ftp,

WWW (World Wide Web). Computer applications; word processing, spread-sheets, data-bases, graphics, scientific software, schedulers. Computer Service.

RECOMMENDED READING

European Computing Driving Licence

ASSESSMENT METHODS: Written exam

SAG.521 - **Crop Experimentation** (3 ECTS)

LECTURER: Dr. I. Zintzaras

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To develop the ability to design crop experiments and analyze experimental data.

PREREQUISITES: BSc knowledge on statistics and crop experimentation.

COURSE CONTENTS

Practical experience in devising, executing, analyzing and interpreting experiments designed to answer specific crop production problems. The design of experiments, techniques of the analysis of randomized complete block designs, latin squares, factorial experiments and split-plot designs. Simple and multiple regressions, their use in modeling agricultural responses. Practical work using computer packages for statistical analysis of data.

RECOMMENDED READING

Mead, R. & Curnow, R. Statistical methods in Agriculture and Experimental Biology. Editor: Chapman & Hall.

R. Mead. The design of experiments. Editor: Cambridge.

Digby & Kempton. Multivarite analyis of ecological communities. Editor: Chapman & Hall.

ASSESSMENT METHODS: Written exam

SAG.531 - **Agro-Ecosystems & Population Dynamics** (3 ECTS)

LECTURER: Dr. E. Kambourakis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To deliver the concept of agro-ecosystem, its structure and its functions. To justify the need to introduce sustainable agriculture systems. Connection with the processes that affect agro-ecosystems in conventional agriculture.

PREREQUISITES: BSc knowledge of ecology and plant sciences.

COURSE CONTENTS

The need for sustainable agriculture. An agroecological analysis. Concepts of sustainablility - Sustainable agriculture systems. Agroecosystems - Populations in agroecosystems. The ecological role of biodiversity in agroecosystems - Agroecosystems diversification. Interaction between agroecosystems and natural ecosystems. Energy in agroecosystems – Emergy. Transition to sustainable food systems.

RECOMMENDED READING

Altieri, M. A. 1995. Agroecology: the science of sustainable agriculture. Westview Press. Boulder.

Altieri, M. A. 1999. The ecological role of biodiversity in agroecosystems. Agriculture, Ecosystems and Environment 77:19-31.

Gliessman, S. R. 2000. Agroecology: ecological processes in sustainable agriculture. CRC Lewis Publishers, Boca Raton

Bailey, A. P., W. D. Basford, N. Penlington, J. R. Park, J. D. H. Keatinge, T. Rehman, R. B. Tranter, C. M. Yates 2003. A comparison of energy use in conventional and integrated arable farming systems in the UK. Agriculture, Ecosystems and Environment 97: 241-253.

Flora, C. (ed.) 2001 Integration between Agroecosystems and Rural Communities. Advances in Agroecology Series. CRC Press, Boca Raton.

Matson, P.A. Parton, W. J., Power, A. G. and M. J. Swift, 1997. Agricultural Intensifications and Ecosystem Properties. Science 277: 504-509.

Pacini, C., A. Wossink, G. Giesen, C. Vazzana, R. Huirne, 2003. Evaluation of sustainability of organic, integrated and conventional farming systems: a farm and field-scale analysis. Agriculture, Ecosystems and Environment 95:273-288.

Pimentel, D. P. Hepperly, J. Hanson, D. Douds, R. Seidel, 2005. Environmental, Energetic, and Economic Comparisons of Organic and Conventional Farming Systems. BioScience 55(7):573-582.

Reganold, J. P., J. D. Glover, P.K. Andrews, H. R. Hinnan, 2001. Sustainability of three apple production systems. Nature 410:926-930.

ASSESSMENT METHODS: Written exam.

SAG.532 – **Ecotoxicology** (3 ECTS)

LECTURER: Dr. L. Belzunces

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Acquisition of the notions on levels of action of pollutants and adverse sublethal effects

PREREQUISITES: Notions of biology, biochemistry, organic chemistry

COURSE CONTENTS

Basis of Ecotoxicology: I. Definitions. II. The pollutions. III. Classification of pollutants. IV. Fate of pollutants.

The pesticides: I. Physico-chemical aspects of pesticides. II. Pesticide treatments III. Fate of pesticides in the IV. Fate of pesticides in the organisms.

Effects of pesticides: I. Levels of action of pesticides II. Impacts of pesticides on agro- and ecosystems.

RECOMMENDED READING

Walker, C. H. & Sibley, R.M., Peakall, D.B., Hopkin, S.P., Hopkin, S.P. (2000). Principles of Ecotoxicology 328pp.

Connell, D.W. (1999). Ecotoxicology 184 pp.

ASSESSMENT METHODS: Written exam

SAG.533 – **Agro-Environmental Impact Assessment and Farm Management** (3 ECTS)

LECTURER: Dr. G. Haas

TYPE OF COURSE AND TEACHING METHODS: Lectures

- Students will be able to understand and measure the impact of different farming systems to the environment.
- The delivery of the basic principles of ecotoxicology.

OBJECTIVE OF THE COURSE: Main objective are the different environmental impacts a farm has on the environment depending on its intensity level, farm management strategies and farming system.

PREREQUISITES: Bsc knowledge on plant sciences and concepts of agro-ecology.

COURSE CONTENTS

Environmental impact of agriculture, grouping environmental impact in different categories, such as "fossil energy and resource consumption", "climate change/global warming potential", "water quality", "soil strain", "eutrophication", "acidification", "human- and ecotoxicity", "biodiversity", "landscape image", "animal welfare", link categories with agri-environmental indicators; the life-cycle-assessment method (ISO 14040); using nutrient budgets at different levels as a farm management and an environmental impact weak point analyses tool; comparing the environmental impact of organic and conventional-integrated farming systems; agri-environmental policies and supporting programs (e.g. "cross compliance" of the EU); linking environmental impacts and productivity of farming systems; choosing the appropriate functional (reference) unit of an environmental impact; allocation, aggregating, ranking and weighting agri-environmental impacts.

RECOMMENDED READING

Copies of scientific publications handed out to participants.

ASSESSMENT METHODS: Written exam

SAG.534 – **Quality Assurance and Good Agricultural Practice** (3 ECTS)

LECTURER: Dr. I. Vlachoyiannis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide the agriculture production legislation that ensures food safety and quality assurance.

PREREQUISITES: General knowledge on agriculture production process. Agriculture product marketing is desirable but not obligatory.

COURSE CONTENTS

Introduction: Increasing demand that agricultural products: Fulfil legal requirements, safe to the consumer, meet specifications regarding qualitative characteristics and quantities. Additional considerations include minimising environmental impacts and socially responsible labour practices. To achieve standardisation world wide there have been created Standards which cover primary production, sorting, packing and processing of agricultural products. Operations are then inspected, to ensure compliance with the Standards. Moreover, there have been create national and international initiatives for food safety, legality and quality. Examples include the EU farm to fork, the Global Food Safety Initiative et. al.

Overview of Legislation: Directive 93/43/EEC on food hygiene; Legislation concerning packaging materials; Legislation governing the licensing and use of plant production formulations and fertilisers; Legislation concerning pesticide residues; Codex Alimentarius Commission

Primary Production Standards: Organic Farming, Integrated Crop Management, Good Agricultural Practices; Standards created and recognised by wholesaler and retailer chains and organisations; The main aspects of each Standard will be described. Similarities and differences between them will be highlighted. When applicable (e.g. EUREP-GAP Option II), the links between primary production and sorting, packing and processing will be discussed.

Sorting, Packing and Processing Standards: HACCP and the various relevant Standards; ISO 9001:2000; The BRC (British Retail Consortium) Standard; The IFS (International Food Standard); ISO 22000; The main aspects of each Standard will be described. Similarities and differences between them will be highlighted. When applicable (e.g. EUREP-GAP Option II), the links between primary production and sorting, packing and processing will be discussed.

Inspection and Certification Systems: The EN 45004, EN 45011 and EN 45012 Standards for bodies performing Inspections, Product Certification and System Certification, respectively; Accreditation of such Bodies; Product vs. system certification, correlation to the Standards presented in 3 and 4 above; Second and Third Party Audits; The necessary steps to obtain certification

RECOMMENDED READING

ASSESSMENT METHODS: Written exam

SAG.541 – **Soil Properties and Quality Assessment** (2 ECTS)

LECTURER: Prof. V. Keramidas

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Evaluation of soil quality, understanding of nutrient cycles in soil and the development of the ability to consult.

PREREQUISITES: Introduction in Soil Science

COURSE CONTENTS

Soil quality with regards to agriculture, chemical, compound behaviour. Surplus-limiting supplies of nutrients and contaminants, risk assessment protocols, fertilizer recommendations. Soil degradation: problems and solutions (acidification, salinity, erosion, soil conservation). Nutrient flows in soils / Dynamics of nutrients and contaminants: mobility, bioavailability, soil quality assessment / Pathways of nutrient inputs & exports / N, P, K cycles. Outline of the policy legislation.

RECOMMENDED READING

ASSESSMENT METHODS: Written exam

SAG.542 – **Composting Technology** (1 ECT)

LECTURER: Dr. G. Zervakis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Understanding compost nature and preparation methodologies. Presenting modern composting technologies, and outlining current applications of composts in agriculture and environment protection

PREREQUISITES: Soil microbiology, soil science, plant nutrition, plant pathology, environmental biotechnology

COURSE CONTENTS

Soil Nature of composts - Principles of solid sate fermentation - Main factors controlling compost preparation. Compost technology: processing methodologies of agricultural, agro-industrial and urban wastes and by-products – infrastructure required for compost preparation – design of a composting site. Applications of composts and pertinent technologies in agriculture and environment protection: compost as conditioners of agricultural soils – compost and its effects on plant nutrition and productivity – compost suppressiveness against soil-borne plant diseases – use of composts in soil bioremediation, and bio-treatment of agro-industrial wastes and pollutants – compost for erosion control and landscape maintenance.

RECOMMENDED READING

Akhtar, M. And M.M. Alam. (1993). Utilization Of Waste Materials In Nematode Control: A Review. Bioresource Technology 45, 1-7.

Cole, M.A., L. Zhang, And X. Liu. (1995). Remediation Of Pesticide Contaminated Soil By Planting And Compost Addition. Compost Science And Utilization 3, 20-30.

Cook, R.J. (1993). Making Greater Use Of Introduced Microorganisms For Biological Control Of Plant Pathogens. Annual Review Of Phytopathology 31, 53-80.

De Bertoldi, M., P. Bert, And P. Tiziano. (1996). The Science Of Composting. London: Blackie Academic And Professional.

Ehaliotis, C., Zervakis, G.I. And P. Karavitis. (2005). Residues And By-Products Of Olive-Oil Mills For Root-Zone Heating And Plant Nutrition In Organic Vegetable Production. Scientia Horticulturae 106, 293-308.

European Union (2001). Applying Compost – Benefits And Needs. In Proceedings Of A Seminar Held In Brussels On 22 And 23 November 2001 (Http://Europa.Eu.Int)

Finstein, M.S., And M.L. Morris. (1975). Microbiology Of Municipal Soil Waste Composting. Advances In Applied Microbiology 19, 113-151.

Gasser, J.K.R. (1985). Composting Of Agricultural And Other Wastes. London: Elsevier Applied Science Publishers.

Hogan, J.A. (1998). Composting For Soil Remediation. In Biological Treatment Of Hazardous Wastes, By G.A. Lewandowski And L.J. Defilippi. New York, Ny: John Wiley And Sons, Inc..

Hoitink, H.A.J., And P.C. Fahy. 1986. Basics For The Control Of Soil-Borne Plant Pathogens With Composts. Annual Review Of Phytopathology 24: 93-114.

Jackson, D.V., J-M. Merillot And P. L'hermite (1992). Composting And Compost Quality Assurance Criteria. Pub. Commission Of The European Communities.

Kavroulakis, N., Ehaliotis, C., Ntougias, S., Zervakis, G.I. And K. Papadopoulou. (2005). Local And Systemic Resistance Against Fungal Pathogens Of Tomato Plants Elicited By A Compost Derived From Agricultural Residues. Physiological And Molecular Plant Pathology 66, 163-174.

Ntougias, S., Ehaliotis, C., Zervakis, G., Katsaris, P. And K. Papadopoulou. (2003). Monitoring The Composting Process Of Different Agricultural Wastes And Evaluation Of The Effects Of The Final Products On Plant Growth. In Proceedings Of The 8th International Conference On Environmental Science And Technology, Pp. 666-673. Edited By T.D. Lekkas. University Of The Aegean & Globalnest, Lemnos.

Schnoor, J.L., L.A. Licht, S.C. Mccutcheon, N.L. Wolfe, And L.H. Carriera. 1995. Phytoremediation Of Organic And Nutrient Contaminants. Environmental Science And Technology 29, 318a-323a.

Sequi, P. (1996). The Role Of Composting In Sustainable Agriculture. In: De Bertoldi, M., P. Sequi, Lemmmes, B. & T. Papi (Edit.) The Science Of Composting. Pub: Blackie, London. 23 - 29.

Struwe, S. And A. Kjøller (1986). Changes In Population Structure During Decomposition. In Microbial Communities In Soil, Edited By V. Jensen, A. Kjøller, And L.H. Sørensen, 149-162. London: Elsevier Applied Science Publishers.

United States Environmental Protection Agency (1997). Innovative Uses Of Compost: Disease Control For Plants And Animals. Http://Www.Epa.Gov.

Wuest, S. And K. Skirvin (1999). Crop Residue And Plant Health: Research Overview And Implications For No-Till. Columbia Basin Agricultural Research Annual Report. Spec. Rpt. 999, Pp. 81-84.

ASSESSMENT METHODS: Written exam

SAG.543 – **Nutrient Management and Soil fertility Improvement** (3 ECTS)

LECTURER: Prof. U. Koepke

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Decision making with regards to sustainability in the Mediterranean soil types and crops.

PREREQUISITES: Soil Science

COURSE CONTENTS

Maintenance of soil's capacity to supply the nutritional needs of plants: Nutrient dynamics in soil and nutrient demand of crops, the problem of synchronization. Organic matter: Importance of organic matter management; organic matter decomposition models. Overview on organic fertilizers available in different farm types and their effects on soils and crops: Farmyard manure, slurry, liquid

manure, manure compost etc. Nutrient losses during manure storage and application, strategies for reducing them; Green manure, legume crops, intercropping etc.; Rock meal and rock phosphate. Nitrogen input: Nitrogen input to the farm – cultivation of legume crops: Overview on species and types; Factors influencing the nitrogen input; Factors influencing nitrogen (nutrient) losses and strategies for reducing them; Use of legume N in the crop rotation. Case studies: Tools to achieve sustainable nutrient management. Nutrient management of vegetables, olive trees, vineyard, citrus trees.

RECOMMENDED READING

ASSESSMENT METHODS: Written exam.

SAG.544 – **Water Management** (3 ECTS)

LECTURER: Dr. K. Chartzoulakis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To develop expertise (computational and measuring methods) for efficient water use.

PREREQUISITES: BSc knowledge on evapotranspiration, root water uptake by plants, transport of solutes, water- and salt stress.

COURSE CONTENTS

Introduction: Review of historical evolution of irrigation and drainage, Water resources in the world and water agricultural uses, Water-stressed countries and agriculture, Constraints in agricultural water planning, distribution and management, Examples of non-sustainable water management.

Water balance of agricultural lands: Scales of study, Basics of soil water balance, Basics of crop evapotranspiration, Control of water balance in the root zone, irrigation and drainage. Agricultural Water Use Efficience: The WUE concept, How to increase WUE? Examples of WUE for some crops and irrigation strategies. Estimation of crop water requirements: Review of existing methods, The Penman-Monteith formula, Concept of crop coefficient Applications. Exercises). Sustainable on-farm irrigation: Irrigation efficiencies, Irrigation scheduling, Irrigation methods, Basics of localized irrigation, Examples of irrigation strategies for saving water. Applications. Exercises.

Sustainable drainage: Principles of agricultural drainage, Objectives and methods, Some examples of drainage systems.

RECOMMENDED READING

Review of World Water Resources by Country (2003). FAO Ed., Rome www/fao.org.

Postel, S. (1999). Pillar of Sands. Can the Irrigation Miracle last? W.W. Norton & C^{o}, New York. Publisher: W. W. Norton & Company.

ASSESSMENT METHODS: Project Presentation.

SAG.551 – **Agrobiodiversity Assessment and Management** (3 ECTS)

LECTURER: Mrs S. Kell

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Basic knowledge and understanding of the theoretical, practical and socio-political aspects of agro-biodiversity assessment and conservation management.

PREREQUISITES: Some knowledge of basic population genetics is an advantage, but the course will provide background information on this topic.

COURSE CONTENTS

Agro-biodiversity assessment and management: What is agro-biodiversity? Definitions and introduction to the concepts of landraces and crop wild relatives. Introduction to the principles of genetic, taxonomic and ecosystem diversity. Outline of the threats to agro-biodiversity and the need for conservation management. Introduction to the socio-economic aspects of agro-biodiversity conservation management. Outline of legislation in place for agro-biodiversity conservation, with emphasis on the Convention on Biological Diversity (CBD).

Assessing and understanding agro-biodiversity: Introduction to the basic principles of conservation genetics. Outline of methods for assessing and measuring agro-biodiversity at genetic, population, species and ecosystem levels. Brief review of the variety of life forms. Introduction to applied taxonomy and its importance in agro-biodiversity conservation.

Plant genetic resource (PGR) conservation: Overview of the conservation and use of PGR. Selection of target taxa and target regions for conservation. Introduction to plant conservation strategies and techniques, including complementary conservation. Overview of in situ conservation techniques (genetic reserve and on farm). Overview of ex situ conservation techniques, including germplasm collection, seed gene bank storage, field gene banks, botanic gardens, in vitro, DNA and pollen storage. Brief introduction to germplasm characterisation, evaluation and use. Highlight the issues of germplasm health, movement and quarantine. Introduction to participatory plant breeding and community involvement in domesticated species conservation.

Case study: Agro-biodiversity assessment and management in the Palestinian Authority.

Practical: Read handout on genetic engineering and GMOs, preparation of group presentations on the GMO debate.

Field trip to agricultural area. General observation and discussion of agro-biodiversity issues in situ. Demonstration and practice in collecting herbarium specimens. Practice in collecting specimen and site data. Introductory practical training in field survey and sampling techniques.

RECOMMENDED READING

Heywood, V.H. and Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press, Cambridge ISBN 0-521-56481-6 pbk

Meffe, G.K. and C.R. Carroll. 1997. Principles of conservation biology. 2nd Edition. Sinauer Associates Inc. ISBN 0-87893-521-5 hbk

Falconer DS and Mackay TFC (1996) Introduction to Quantitative Genetics, 4th edn, Longman

Glowka L (1994) A Guide to the Convention on Biological Diversity, IUCN, Gland and Cambridge, pages 3̃38

Plant Genetic Conservation: the In Situ Approach ed Maxted N, Ford-Lloyd BV and JG Hawkes, Chapman & Hall

Frankel, O.H., A.H.D. Brown and J.J. Burdon. (1995) The Conservation of Plant Biodiversity. Cambridge University Press, Cambridge.

Given, D.R. (1994) Principles and Practice of Plant Conservation. Chapman and Hall, London.

Wood, D. and Lenné J.M.(1999) "Agrobiodiversity: characterization, utilization, and management." CAB International, Wallingford, UK.

FAO (1996) "Global plan of action for the conservation and sustainable utilization of plant genetic resources for food and agriculture." FAO, Rome.

ASSESSMENT METHODS: Written exam/ Assignment

SAG.552 – **Seed Production and Quality Management** (2 ECTS)

LECTURER: Dr Wilco Ligterink

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To get acquainted with seed biology, seed technology and seed quality control.

PREREQUISITES: BSc knowledge on botany, plant biology

COURSE CONTENTS

Seed Biology: Seed anatomy, germination, water relations during germination, seed maturation and dormancy, desiccation tolerance, orthodox and recalcitrant seeds, seeds and biodiversity.

Seed quality: Improvement of seed quality by priming and sorting, different ways of seed storage, influence of storage on seed quality, seed health, detection of pathogens on seeds, seed production for organic farming.

Seed testing: Ways on how to address seed quality: measurement of seed germination characteristics, use of Seed Calculator program to measure germination characteristics, different ways of testing the vigor of seed lots, prediction of the storage life of seeds, use of 'high tech' tests like microarray analysis, proteomics, fluorescence sorting, immuno-fluorescence

RECOMMENDED READING

Bradford, KJ and Hilhorst HWM (2003) Syllabus Seed Biology, Production and Quality.

Ellis, RH (1992) Seed and seedling vigor in relation to crop growth and yield. Plant-Grow-Regul. 11 (3): 249-255.

Hampton, JG, de Carvalho, NM, Kruse, M, Don, R, Brodal, G, Come, D, Copeland, LO (2002) Quality seed: A factor for sustainable progress. Seed Science and Technology. 30 (2): 463-475.

McGee, D.C. (1998) Initiatives to improve the international seed health system: a review. Seed-technol. 20 (1): 18-22.

ASSESSMENT METHODS: Written Exams.

SAG.553 – **Plant Breeding** (1 ECTS)

LECTURER: Prof G. Skarakis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Understanding the significance of genetic diversity and acquiring knowledge on current basic approaches for the development of plant cultivars to be integrated in sustainable production systems.

PREREQUISITES: A basic knowledge of Principles of Plant Breeding, Biometry and Molecular Biology.

COURSE CONTENTS

Seed legislation and policy: Testing for distinctness, uniformity and stability (DUS) in relation to variety registration and protection according to the guidelines of UPOV. Identification of varieties by conventional and novel methodology.

Genetic Resources and Diversity: Origin of natural genetic diversity and its utilization in plant breeding, development of usable genetic variation by classical and biotechnological approaches.

Plant Breeding: Breeding for yield, quality and resistance to biotic and abiotic stresses towards a sustainable Agriculture. Breeding for organic farming.

RECOMMENDED READING

Simmonds, NW & Smart, J. 1999. Principles of Crop Improvement (Chapters 1-3 &10). Blackwell Science Ltd. ISBN : 0-632-04191-9

Fehr, W.R 1987. Principles of Cultivar Development (Chapters 18,21 &32) Macmillan Pub.Co. ISBN :0-02-949920-8.

Hayward, M.D., N.O Bosemark and I.Romagosa, (eds) 1987. Plant Breeding

Principles and prospects (Chapter 22). Chapman & Hall ISBN:0-412-43390-7

Ceccarelli, S., 1996. Adaptation to low/high input cultivation. Euphytica 92: 203-214

Braun,HJ., S. Rajaram and M. van Ginkel, 1996. CIMMYT's approach to breeding for wide adaptation. Euphytica 92: 175-183

Michelmore, R., 2003. The impact zone: genomics and breeding for durable resistance. Current Opinion in Plant Biology 6: 397-404

Kelly A.F. and R.A.T. George (eds) 1998. Encyclopedia of Seed Production of World Crops (Technical Aspects of Quality Control p.70-111).

ASSESSMENT METHODS: Written Exams.

SAG.554 – **Biotechnological Approaches to Plant Propagation** (3 ECTS)

LECTURER: Prof. A. Economou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: A detailed and thorough presentation of the techniques used for in vitro plant regeneration.

PREREQUISITES: Knowledge on the reproduction mode of crops, plant morphology, plant physiology and plant anatomy. Basic knowledge on laboratory techniques used in plant biotechnology. Knowledge on plant regeneration and morphogenesis is desirable.

COURSE CONTENTS

Introductory history, laboratory equipment and requirements, general techniques, composition and preparation of nutrient media. Morphogenesis, organogenesis and embryogenesis. Haploid production (anther and pollen culture), protoplast isolation and culture, somatic hybridization and zygotic embryo rescue. In vitro cloning of various plant species. Somaclonal variation. Thermotherapy, meristem culture and production of virus-free plants. In vitro germplasm storage and cryopreservation.

RECOMMENDED READING

Sangwan, R.S. & Sangwan-Norreel, B.S. Anther and Pollen Culture. Univ. de Picardie, France

ASSESSMENT METHODS: Written exam

SAG.561 – **Plant/Pest Interactions & Integrated Pest Management** (3 ECTS)

LECTURER: Prof. Tsitsipis & Prof. Paplomatas

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Ecological understanding of the interactions between plant pathogens, pests, weeds and plants. Defining Integrated Pest Management. Understanding the concept of plant resistance against pathogens.

PREREQUISITES: BSc level plant pathology, entomology, weed science. Knowledge of the biological cycles of insects, fungi and weeds.

COURSE CONTENTS

Bio-interactions of pests, diseases and hosts: Relationship between predators and prey, parasitoids and hosts, pathogens and hosts, antagonists and hosts. Interactions between injurious and beneficial organisms. Multi-trophic interactions (indirect interactions among organisms from different trophic levels). Semio-chemicals (kairomones, synomones, pheromones). Disease development and prediction modelling: Disease development: how pathogens attack plants - how plants defend themselves. Relation between injury, damage and loss - possibilities to predict the development of

pests, diseases, antagonists and natural enemies. Disease Resistance: Non host resistance, partial, polygenic, horizontal resistance – monogenic, R gene, vertical resistance, principles of breeding for resistance, "Boom & Bust" cycle. Integrated Pest Management: Integrated pest management, and more in particular, biological control, genetic control and the new developments in these areas. Effects of cultural control measures (e.g. inter-cropping) on pest and disease development.

RECOMMENDED READING

ASSESSMENT METHODS: Written exam

SAG.562 – **Fungal and Bacterial Disease Management** (3 ECTS)

LECTURER: Prof. E. Tjamos

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Latest scientific advances towards the sustainable management of plant fungi and bacterial diseases.

PREREQUISITES:. Plant fungi and bacterial diseases. Epidemiology and biological cycles of fungi.

COURSE CONTENTS

Alternatives to chemical control: Development of fungicide resistance and evolution of fungicide resistance. Alternatives to methyl bromide usage for the control of soil-borne pathogens. Biodegradable chemicals. Control of fungi and bacterial diseases: Physical, cultural and biological methods that eradicate, avoid or reduce the inoculum. Biological control: Fungal & bacterial antagonists (e.g. soil-borne fungi, soil-born fungi population dynamics). Suppressive soils. Resistance: Successful cases of plant resistance against fungi and bacteria. Case studies: vegetables, olive trees, vineyard, citrus trees.

RECOMMENDED READING: AGRIOS, G. N. (2005). PLANT PATHOLOGY 952P

ASSESSMENT METHODS: Written exam

SAG.563 – **Detection and Epidemiology of Plant Virus Diseases** (3 ECTS)

LECTURER: Prof. N. Katis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To be familiar with the latest developments on virus detection methods. Usage of virus epidemiology knowledge for the prevention or control of plant virus diseases. To present latest advances on the production of virus free plant propagation material.

PREREQUISITES:. Basic knowledge on plant pathology and plant virology.

COURSE CONTENTS

Detection of plant viruses and viroids: indicator hosts, cytological effects, serological assays, molecular assays. Transmission and epidemiology of plant viruses and viroids: mechanical, seed, insect, fungal, nematodes, pollen. Control of plant viruses and viroids: plant virus control based on their epidemiological properties, farming practices to avoid-reduce inoculum, physical methods of protection, cross protection, antiviral agents. Virus-free seed production, propagation and maintenance of virus-free plants. Case studies in the Mediterranean area.

RECOMMENDED READING Hull, R. (2001). Plant Virology 1056p.

ASSESSMENT METHODS: Written exam

SAG.564 – **Insect Management** (3 ECTS)

LECTURER: Prof. E. Kapetanakis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Understanding the development of insecticide resistance. Latest scientific advances towards an environmental friendly management of insects and mites.

PREREQUISITES: Insect biology, taxonomy, life cycles of major insect pests.

COURSE CONTENTS

Resistance to pesticides: How resistance in pesticides builds up in arthropods? Pesticide selectivity. Biological control: Types and methods - Natural enemies - Predators-Parasitoids - Protozoa, Fungi, Nematodes and Viruses as biocontrol against arthropods. Culture & colonization of beneficial arthropods - Population dynamics - Risk assessment of biological control of insects - Products available - Does biological control work in nature and farming practice? Successful cases of biological control in the Mediterranean area (olive, citrus, vegetables, grapevine).

RECOMMENDED READING

General Entomology:

McGavin, G.C. & Lewington, R. (2001). Essential Entomology: An Order-By-Order Introduction, Oxford University Press.

Gullan, J. Cranston, P.S., Hansen, K., McInnes, K. (2004). The Insects: An Outline of Entomology. Alfont Blackwell Publishers,

Agricultural Entomology:

Hill, D.S. & Hill, J.D. (1994). Agricultural Entomology. Timber Press.

Biological Control:

Helyer, N. Fargro Ltd, Brown, K., Cattlin, N.D. (2003). A Colour Handbook of Biological Control in Plant Protection. Holt Studios International Blackwell Publishing.

Hajek, A.E. (2004). Natural Enemies: An Introduction to Biological Control, Cambridge University Press.

Biotechnological Control:

Rechcigl, J.E. & Rechcigl, N.A. (1999). Biological and Biotechnological Control of Insect Pests, Lewis Publishers.

Pest Management:

Thacker, J.R.M. (2002). An Introduction to Arthropod Pest Control. Cambridge University Press.

Pedigo, L.P. (2001). Entomology and Pest Management (4th Edition), Prentice Hall

ASSESSMENT METHODS: Written exam

SAG.565 – **Weed Management** (3 ECTS)

LECTURER: Prof. I. Eleftherohorinos

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE:

PREREQUISITES:

COURSE CONTENTS

Factors affecting weed-crop interference. Integrating all available methods (soil and cultivation practices, crop rotation, choice of variety, crop establishment, crop nutrition strategy, and choice of herbicide application) for weed control. Management of weed resistance and aspects of using genetically modified crops with herbicide resistance. Incorporating Weed Management Strategies in the Integrated Pest Management System. How does herbicide resistance develops? When do we

need to manage weed populations? Examples of allelopathy for the control of weeds. Rotation schemes to manage weeds. Case studies: vegetables, olive trees, vineyard, citrus trees.

RECOMMENDED READING

Monaco, T.J., et al., (2002). Weed Science. Principles and practices. 4th Edition.

El Naylor, R. (2002). Weed Management Handbook, 9th Ed., Blackwell. Weed Science – Principles and Practices. T.J. Monaco, S.C. Weller, F.M. Ashton, John Wiley & Sons, INC.

Walker, R.H. Preventive Weed Management, Auburn University, Auburn, Alabama

ASSESSMENT METHODS: Written exam

SAG.566 – **Biotechnological Approaches to Crop Protection** (3 ECTS)

LECTURER: Dr. I. Livieratos

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To familiarize with latest biotechnological attempts in crop protection against fungi, bacteria, viruses, weeds and insects.

PREREQUISITES: Basic knowledge on plant molecular biology.

COURSE CONTENTS

Genetic engineering and biotechnology. Central dogma of the transfer of genetic information from DNA to RNA to protein. Molecular biology techniques for the identification of nucleic acids and proteins. Milestones in agricultural biotechnology. Practical Molecular Biology Techniques.

A. Pathogenicity and virulence genes in plant pathogens. Gene-for-gene interaction and genetics of resistance through the hypersensitive response. Identification and isolation of avirulent (avr) and resistance (R) genes. Characteristics of avr gene-coded proteins. Resistance genes in plants: classes and evolution. The guard hypothesis.

B. Signals in plant-microbe interactions. Genetic and pharmacological evidence of the role of salicylic acid (SA), jasmanic acid (JA) and ethylene (ET) in disease resistance. Cross-talk between defense pathway systems. Identification of induced genes. Defense signaling network in Arabidopsis.

C. Replication of plant RNA viruses and strategies for genome expression. Resistance sources against plant viruses: a. natural, b. virus itself (PDR), c. various other. Resistance mechanisms to plant viruses using pathogen derived resistance (PDR) (an overview). Post-transcriptional gene silencing (PTGS) and PTGS suppressors.

D. How and what gene to express for resistance agaist pathogens. Different strategies and promoters used for engineering increased disease resistance in plants.

E. Mode of action of Bacillus thuringiensis (Bt) crystal proteins. Biological considerations and genetic manipulation of Bt. Crystal protein resistance in insects.

F. Approaches to engineer herbicide tolerance: a. modification of the target of the herbicide action, b. detoxifification of the herbicide. Strategies to engineer tolerance to glyphosate.

G. Potential direct and indirect impacts of transgenic crops on the environment. Risk quantification. Persistence or invasiveness of crops. Gene flow from crops to related species. Order and elements determining the likelihood and consequences of gene flow. Strategies to delay resistance (resistance management). Methods for the detection of GMOs.

RECOMMENDED READING

ASSESSMENT METHODS: Written exam

SAG.571 – **Crop Modelling and Bioclimatology** (3 ECTS)

LECTURER: Dr. M. Tchamitchian

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Students should be able to apply models to correlate environmental fluctuations and crop growth.

PREREQUISITES: BSc knowledge on mathematics and plant physiology

COURSE CONTENTS

Bioclimatology: Energy balance: radiative balance (radiation, spectrum, units, measurements, elementary laws of radiation physics, radiative balance), temperature (units, measurements), conductive heat transfer (mono-directional transfer law, transfer in soil), wind speed (units, measurements), convective heat transfer (definitions around convection and boundary layer, laws of convective fluxes, convective heat flux expressions), air water content (units, expressions, measurements) latent heat transfer (relation to evaporation), determination and use of energy balance, application to greenhouses.

Plant and crop responses to environmental factors: light and radiation (light and development and photosynthesis, optical properties, light extinction in crops, Monteith approach to production estimation), temperature (heat units, Q10, (radiative) frost action), water (definitions of evapotranspiration, potential and actual evapotranspiration, Penman and Penman-Monteith expressions, cropping coefficient definition and use).

General structure of crop models: elementary processes (photosynthesis, temperature effect integration, maintenance respiration), integrated processes (carbon balance, growth, organogenesis and organ ageing, assimilates partitioning, mineral uptake, water uptake), dry matter to leaf area conversion (SLA, LAR).

TOMGRO and TOMSIM, the greenhouse tomato case: details of the function expressions, experimental setup for calibration/validation, input/output data.

A case with soil: soil description, water fluxes, soil module calibration/validation experimental setup, input/output data, connection to the crop model.

Crop modelling in use: agricultural early warning (irrigation vs crop phenological stage prediction and/or potential evaporation, pesticide application vs pest development prediction).

RECOMMENDED READING

Unsworth, M. & Monteith, J.L. (2005). Principles of Environmental Physics. Publisher: Academic Press.

Bakker, J.C., Bot (Editor), G.P.A., Challa, H. & Van De Braak, N.J. Greenhouse Climate Control: An Integrated Approach. Publisher: Wageningen Academic Publishers.

Guyot, G. (1996). Physics of the Environment and Climates (Wiley-Praxis Series in Atmospheric Physics & Climatology). Praxis Publishing.

ASSESSMENT METHODS: Written exam.

SAG.572 - **Greenhouse Technology and Climate Control** (3 ECTS)

LECTURER: Prof. K. Kittas

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To obtain knowledge and expertise on modern greenhouse constructions and climate control.

PREREQUISITES: BSc knowledge on mathematics, physics, environmental physiology.

COURSE CONTENTS

Greenhouse structures: Greenhouse types, cover and construction materials for greenhouses, design norms for greenhouse construction. Greenhouse environment: Greenhouse energy and mass balances (radiation exchanges, sensible, latent and CO2 fluxes). Evapotranspiration under cover. Climatic suitability of a region for protected cultivation. Greenhouse equipment for climate control: Heating of greenhouses (estimation of heating requirements, heating systems, heat distribution networks) . Cooling of greenhouses: Natural Ventilation, Dynamic Ventilation, Fan and pad evaporative cooling system, Fog evaporative cooling system, Shading systems; Climate control systems. Energy saving technologies: Thermal screens, windbreaks, thermal insulation of the greenhouses. Renewable energies sources (solar, geothermal, biomass) for heating greenhouses. Emerging technologies for Sustainable Agriculture in greenhouses: Insect proofs, UV absorbing and anti-drop cover materials.

RECOMMENDED READING

ASSESSMENT METHODS: Written exam

SAG.573 - **Soilless Culture** (3 ECTS)

LECTURER: Prof. D. Savvas

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Detailed overview in soilless agriculture production methodologies. Emphasis is given on closed soil-less culture systems.

PREREQUISITES: Soil science, organic and inorganic chemistry. Plant nutrition.

COURSE CONTENTS

Introduction –Terminology

Substrates: Physical properties of substrates (bulk density, particle size distribution, porosity, water release curves, hydraulic conductivity, impact of physical properties on irrigation management in hydroponics). Chemical properties of substrates (pH, ion sorption, ion exchange). Substrate analysis (determination of water soluble and exchangeable nutrients, CEC, AEC, organic matter content, pH, EC). Description of substrates (sand, gravel, rockwool, expanded minerals, pumice, zeolite, pyroclastic materials, peat, coir, tree bark, sawdust, wood fibres).

Hydroponic systems: Systems involving solely water as a substrate (deep water culture, floating hydroponics, NFT, plant plane hydroponics, aeroponics). Systems involving an aggregate as a substrate (bag culture, container culture, trough culture, thin layer systems, various alternative systems). Equipments in hydroponics: Installations used to prepare and deliver nutrient solution, sensors, equipment for the lay-out of the crop, equipment for irrigation and nutrient solution recycling.

Water and nutrient management in hydroponics: Irrigation control in hydroponics. Composition of nutrient solution, Effects of pH, EC and nutrient ratios on plant growth, yield and quality. Calculation of nutrient solutions for open systems. Management of nutrient solution in open systems. Introduction to nutrient solution recycling. Methods of nutrient solution recycling. Calculation of nutrient solutions for closed systems: concept of drainage solution plus fresh water, concept of uptake concentrations or uptake ratios.

Disinfection in hydroponics: Nutrient solution disinfection (heating, UV-irradiation, chemical treatments by means of ozone, hydrogen peroxide, chlorine, iodine, etc., membrane filtration, slow

sand filtration). Disinfection of substrates (steaming, solarization, chemical sterilization, other techniques).

Hydroponics, product quality and integrated crop management in greenhouses.

RECOMMENDED READING

D. Savvas and H.C. Passam (eds) (2002). Hydroponic Production of Vegetables and Ornamentals. Embryo Publications, Athens.

ASSESSMENT METHODS: Written exam

SAG.VIII - **Case Studies in Organic Production**

LECTURER: Dr. E. Kambourakis / Prof. H. Passam/ Dr. S. Lionakis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Field-work.

OBJECTIVE OF THE COURSE: To obtain on-site field expertise in organic and sustainable agriculture production.

PREREQUISITES: Overall BSc level knowledge of agriculture practices on Mediterranean crops.

COURSE CONTENTS

Case Studies and excursions in Olive Tree, Vegetable, Citrus and Vine Cultivation

RECOMMENDED READING

ASSESSMENT METHODS:

ACADEMIC SUPPORT FACILITIES

Laboratory of Soil Science and Plant Tissue Analysis

The main axes of activities are:

- Specification of the composition of soils and the quantitative and qualitative analysis of plant tissues.
- Increase of soil fertility through optimum fertilization per crop per growth stage.
- Development of databases for a) soil quality and b) crop fertilization.
- Identification of environmental pollution through overuse of fertilizers. Development of database for underground water quality.
- Specifications of optimal composition of water-soluble fertilizers.
- Quality control of chemical supplies related to horticulture.
- The facilities include an extended line-up of up to date computer assisted instrumentation.
- One microwave apparatus for samples digestion
- One Inductively coupled plasma Atomic Emission Spectrometer (ICP-AES) for the determination of metal content of soils, plant tissues and waters
- One UV-Vis spectrophotometer
- A complete Kjeldahl apparatus for the determination of total nitrogen
- A variety of electrodes for the detection of several ions, etc.

Laboratory of Seed Germination Testing

The seed bank Of MAICh was established according to international standards given by the IBPGRI For the collection of the seeds, as well as for further processing and manipulation (drying, cleaning, storage and general management of the seedlots), international standards and recommendations are followed.

The scientific staff of the laboratory is well experienced ın the collection and curation of the endemic and threatened plants of Crete.

Parameters study include: seed weight, storage behaviour, dormancy types and dormancy release treatments, temperature requirements of germination and rate of germination.

Botanical Garden of Endangered Species

The Botanical Garden of MAICh is located in the campus covering an area of approximately 6 ha and intends to shelter native Mediterranean plants. An area of 3,500 square meters is dedicated the ex situ conservation of Cretan endemic and threatened species. The garden will also include a field gene bank of local varieties of cultivated plants.

The Botanical garden, in addition to the ex-situ conservation of the threatened and Cretan endemic flora, aims to study the biology of the plants and to raise the public awareness on the value of biodiversity and the significance of conservation.

Thematic collections of the garden will focus on groups of plants of special importance such as wild relatives of cultivated species, medicinal and aromatic plants, wild food plants, dye plants, ornamental plants etc.

Herbarium of Cretan/ Mediterranean Flora

The Herbarium of the Mediterranean Agronomic Institute has been designed to include voucher specimens of all plant taxa of the Cretan flora and it has the necessary infrastructure for the accurate identification of plant species of the Mediterranean region in order to provide maximum contribution to educational needs and research on the Mediterranean flora.

The functions of the Herbarium cover: a) loans b) providing facilities for visiting botanists c) identifying specimens relevant to the region d)collecting material from the field to be used for various studies, such as, anatomy, cytology, ecology, conservation, plant breeding, pharmacology, biochemistry, ethnobotany.

Seed Bank for
A) Endemic and Endangered Native Species and
B) Local Horticultural Varieties Under Extinction

The seed bank of MAICh, which is closely associated with the Herbarium and the Botanical Garden, contributes in the ex–situ conservation of the plant biodiversity of the Mediterranean region. The infrastructure includes mainly a Dry Room and a Cold Room for seed preparation and long–term storage; its present capacity amounts to approximately 10,000 accessions.

The seed bank aims not only to store seeds of threatened plants but also to provide germination protocols for each species included, as well as information on germination ability of each accession, which is examined periodically. An interactive data base is under development and it will contain information on the taxonomy, conservation status, habitat and distribution (GIS), and reproductive biology of each plant taxon as well as specific information characterizing each accession.

Greenhouses

Seven individual glasshouses of the venlo type totaling 930 m^2 and one nursery 150 m^2 , provide the infrastructure and necessary support for specialized post –graduate research. The microclimate in glasshouse is controlled and maintained by computer. The control parameters include temperature, relative humidity, screen control, CO_2 enrichment and total radiation, ascertained in conjunction with a meteorological station.

One of the glasshouses is dedicated to a number of rooting beds with automated humidity and temperature control.

A soil less hydroponics system with nutrient recycling capacities is installed in each of the four glasshouses, dedicated to soilless cultivation, to examine different conditions (substrates, decontamination methods of drainage, solution optimum in nutrient recipes etc.). Results of these studies are going to be applied to Mediterranean crops.

MASTERS OF SCIENCE PROGRAM

Research Project (9 month duration)

Requirement

60 ECTS credits. Laboratory techniques (Related to the subject of the Master Thesis)

Research Subject Areas (topics generally available for Master of Science thesis)**:**

- Plant nutrition and hydroponics
- Greenhouse management
- Soil fertility and plant production
- Plant protection in horticultural crops
- Post-harvest quality of agro products
- Plant virology

Indicative master thesis realized within the area

TITLE: Alternative Methods for Quality Preservation and Decay Control Caused by Botrytis Cinerea and Alternaria Alternata of Sweet Red Pepper (Capsicum Annum cv. Florinis), (2003)

AUTHOR: Semida Wael, Agronomist, Egyptian

PLACE OF REALIZATION: Aristotle University of Thessaloniki, Greece

THESIS DIRECTOR: Evangelos Sfakiotakis

TITLE: Biodiversity of Soil-Dwelling Arthropods within an Organic, a Conventional and an Abandoned Olive Agro-Ecosystem on the Island of Crete, (2003)

AUTHOR: Issa Chahine, Lebanese

PLACE OF REALIZATION: Agricultural Research Center of Heraklion, Greece

THESIS DIRECTOR: Emmaouil Kambourakis, Agricultural Research Center of Heraklion, Greece

TITLE: Impact of Conventional and Organic Management on the Nutritional Status and Economic Performance of Olive Orchards in Crete (2002)

AUTHOR: Efriyam Krishkov, Bulgarian

PLACE OF REALIZATION: MAICH, Greece

THESIS DIRECTOR: Ioannis Metzidakis, Institute of Subtropical Crops and Olive Tree, Greece

TITLE: Emergy Analysis of Organic and Conventional Production of Olive and Olive Oil in Crete, Greece (2001)

AUTHOR: Dalia Khalaf, Egyptian

PLACE OF REALIZATION: MAICH, Greece

THESIS DIRECTOR: Evangelos Sfakiotakis, Aristotle University of Thessaloniki, Greece and Ioannis

References of the main academic staff teaching within the M.Sc.

More than 25 invited lecturers from about 5 countries participate in each edition of the M.Sc. programme of which, 40% came from Research Centres, 60% from Higher Education Institutions. Considering their implication in the programme, the following academic staff is taken as reference:

GREECE

Higher Education Institutions

- E. Tjamos, D. Savvas, E. Paplomatas, G. Skarakis, Agricultural University of Athens
- I. Zintzaras, K. Kittas, I. Tsitsipis, University of Thessaly
- N. Katis, A. Economou, V. Keramidas, I. Eleftherochorinos, Aristotle University of Thessaloniki
- E. Kapetanakis, Professor, Technical Educational Institute of Crete, Heraklion

Research Centres

- I. Vlachoiannis, IDS Institute, Athens
- E. Kambourakis, NAGREF, Heraklion
- G. Zervakis, NAGREF, Kalamata
- C. Hartzoulakis, NAGREF, Chania
- I. Livieratos, MAICh, Chania

GERMANY

Higher Education Institutions

- G. Haas, Institute for Organic Agriculture, University of Bonn
- U. Koepke, Institute for Organic Agriculture, University of Bonn

THE NETHERLANDS

Higher Education Institutions

- W. Ligterink, Laboratory of Plant Physiology, Wageningen Agriculture University

FRANCE

Research Center

- M. Tchamitchian, Horticultural Cropping Systems, INRA, Avignon
- L. Belzunces, Environmental Toxicology, INRA, Avignon

GREAT BRITAIN

Higher Education Institutions

- S. Kell, Agrobiodiversity, University of Birmingham

The Institute reserves the right to replace its visiting faculty according to its evaluation process.

Developmental Support Activities

QUALITY CONTROL CENTRE – LABORATORY SERVICES

Analytical Chemistry / ISO 17025 Quality Assurance System

Accredited services: according to ISO 17025 / EN 45001

Field of applications: Essential oil analyses (GC–MS), Multi–Pesticide Residue analyses utilizing SIM (GC–MS), Organochlorine Pesticides (GC/ECD), Fenthion in Olive Oil (GC–NPD), Stigmastadienes (GC–FID), Sterols (GC–FID), Total phenolics according to Folin–Ciocalteu, Fatty acid methyl esters (GC–FID), UV evaluation of olive oil, Acidity in olive oil (Titrimetric method), Peroxide value (Titrimetric method), Triglycerides (HPLC–RI), Separation of sugars in honey (HPLC–RI).

Soil Science and Plant Tissue Analysis (ISO 9000 Under Development)

The Laboratory of Soil Science and Plant Tissue Diagnostics offers consultation services and provides scientific support to farmers, greenhouse owners, agricultural cooperatives etc.

Analysis of soil samples, growth media and composts include:

Soil. PH, total calcium, active calcium, potassium, sodium, magnesium, chloride, sulphur, iron, phosphorus, total nitrogen, nitrate, ammonium, manganese, zinc, copper, boron, organic matter, sand, clay and silt content.

Plant tissues. Nitrogen, phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, cooper, boron, molybdenum, chloride, sodium.

Water. PH, conductivity, hardness, total salts, calcium, magnesium, potassium, sodium, boron, chloride, sulphur, carbonates, nitrate, cooper, iron, zinc, lithium, manganese, molybdenum, and heavy metals.

Genetically Modified Organisms Analysis of Agricultural Products
(ISO 17025 Under Development)

Qualitative and quantitative GMO analyses of agricultural products are offered to the food and animal feed industry. The agricultural products that are analyzed are comprised of soybean protein, pellets and processed soy for animal feed; maize pellets, kernels and processed maize for baby foods; fish food that contains plant material, cotton seeds and other plant derivatives in processed foods and vegetable oils.

Facilities And Services

ACADEMIC SUPPORT FACILITIES AND DEVELOPMENT ACTIVITIES

Development and Integrated Support for Information Systems

The IST group enhances academic, research, administrative and support activities, through the deployment of appropriate technology. Realization is through the evaluation of institutional needs, application development, pilot implementation and institutional integration of cutting edge solutions. Areas of focus include development (C++, C, Tcl/Tk, Borland Delphi, Python, Visual Basic, Java), Database Integration (MS/SQL, PROGRES, PostgreSQL, ORACLE, MySql), and distributed searching (Z39.50/HTTPD), OGIS WMS/WFS based Web-Mapping and networking technologies (TCP/IP, SOAP, XML-RPC). Emphasis is also given to Green House Monitoring and Environmental Control via RS-485/422 , and to Distance Learning and Multimedia Course Production (Macromedia Director, Author-Ware Attain), with delivery on both CD as well as the WEB.

Computer Units

One Computer Room per graduate programme is dedicated to the 2nd year (M.Sc.) students.

Two independent Computer facilities are dedicated only to the 1st year educational training needs.

Library and Documentation Centre

The library is fully automated and uses the GEAC Advance Integrated Management System. GEAC offers the users access to the library holdings. The Online Public Access Catalogue (OPAC) is accessible via the Institute LAN as well as the internet.

The library holds over 8000 books, 13.000 reprints, over 400 serial titles, MAICh's Master Thesis Collection, a collection of Statistical data, Reference books (dictionaries, catalogues, directories etc), Videocassettes, CD-ROM, and DISK collection, in subjects related to the research and postgraduate activities of the Institute. A reference section which includes CD–ROM databases accessed on–line is incorporated into the system: CAB (1984–up to now), AGRICOLA (1984–up to now), AGRIS (1975–up to now), ECONLIT (1969–up to now), ORGANIC FARMING, etc..

The documentation centre provides paid services upon information retrieval request, selective dissemination of information profiles (S.D.T) and document delivery.

Printing and Publishing

The unit offers a complete range of typesetting, design, digital pre-press, scanning, single or multi-colour printing, copying and binding services to the institute community.

ACCOMMODATION AND RECREATION FACILITIES

Academic Village and Dormitories

Academic Village :The campus is comprised of a complexe of fifteen luxurious stonehouses (apartments), constructed in traditional Cretan architectural style. They are situated on the premises of MAICh, surrounded by a fittingly laid out botanical garden of Mediterranean type.

Every stone house has an open–air terrace of approximately 80 m2. These apartments are placed at the disposal of visiting colleagues, academics, researchers, conference keynote speakers or VIP delegates.

Dormitories: The dormitory complexe of MAICh has a capacity of 50 single and 70 double rooms, which are fully air conditioned, fully wired for TV, telephone and computer network access. A common kitchenette and a TV lounge are available.

Restaurant and Student Lounge: The restaurant has a serving capacity for 260 persons; it is complemented by a snack bar with a large TV screen. Adjacent to the restaurant is a cosy multifunctional lounge with a fire place and multiethnic music collection, designed to accommodate cultural and academic events and activities. The institute's restaurant serves meals (breakfast, lunch and dinner) daily except on Sunday (cold dish is served).

Restaurant Mediterranee: The restaurant provides high quality catering, crucial to the success of any event. Totally committed to supplying the best value for money available, the kitchen provides a blend of elegant surroundings and exquisite traditional Greek dishes or International cuisine. Several arrangements may be offered: a la Carte, self–service, buffets, receptions, cocktail parties, gala dinners, garden parties. (345 m2 indoor restaurant facilities and 500m2 covered terrace).

Athletic Facilities and Recreation: Athletic installations and recreational facilities such as basketball, tennis and volleyball courts, mini soccer (under construction), a TV lounge, bar, billiards, table tennis, a closed gymnasium (near completion), a laundry room, parking area, card phones, and facilities for the disabled.

CONFERENCE AND SUMMER SCHOOL SERVICES

Conference Centre

The Conference Center of MAICh with its versatile design combines first class standards of comfort and service with the latest technology in a prestigious location.

It satisfies the requirements of very sophisticated and advanced conferences. It further accomodates seminars, symposiums, meetings, summer schools and presentations; and it hosts simultaneously or independently exhibitions and poster sessions.

Aristotle: A luxurious 200 seat auditorium (330m^2)

Thales–Heraclitus: A multipurpose hall with 9 simultaneous interpreting booths It can be subdivided into 2 independent meeting rooms and has a total capacity of 200 seats (230 m^2).

Socrates–Theophrastus–Pythagoras–Demokritus: These rooms have maximum versatility according to requirements. They can function as one independent amphitheatre, or the dividing walls separating the four rooms, can be taken down to form one vast space with a total capacity of 260 seats (448 m^2).

Archimedes–Epicurus: Two interconnected exhibition and/or conference halls offering flexible seating and decoration arrangements, total capacity 220 seats (240 m^2).

Conference halls are supported by all modern audio–visual equipment, including video, overhead and slide projectors, video projectors, PHILIPS PROSCREEN 60, large screens, a simultaneous interpreting system, PC, video recorders, cordless microphones, exhibition stands, internet and email access in different places.

All facilities are air-conditioned and have been built in accordance with regulations regarding the disability impaired.

The institution prides itself in more than 12 years of experience in the market of conferences. The highly skilled personnel combine knowledge, professionalism, efficiency, client assistance with a clear vision of the target regarding the needs of each event. The conference staff prepares and carries out meetings, conference seminars, summer school sessions. All these events are assisted by specific tailor-made conference management software.

Services: consulting, promotion, administration and secretariat back up, financing, conception and management of summer schools, V.I.P services, accommodation, transportation, social events, excursions planning.