Chemical Engineering at FEUP - Today and for the future
Notes on Departmental Organization and Course Structure

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By occasion of the Visit of the EFCE Board and
WP and Section Chairpersons
On 16 April 2010

http://www.fe.up.pt/deqwww

To say what I am going to say...

Chemical Engineering at FEUP

- Departmental organization
- Main indicators of activity
- Main features and indicators of the Master degree in Chemical Engineering
DEQ Today, 172 Years after the first course
I - Mission

- The Department of Chemical Engineering is FEUP’s Centre of Human and Material Resources to support activity in the Chemical, Biochemical and Environment Engineering fields:
  - Education at First and Second Cycle Levels (ChemEng, EnvEng, BioEng, in line with the Bologna reforms)
  - Education at third cycle level - Doctoral Courses (Since 2008/09, in line with the Bologna reforms)
  - R&D&I in Research Unit Structures of FEUP, based within the Department
  - Services to the Community - analyses, consulting, etc.

DEQ Today, 172 Years after the first course
II - Staff and Research Organization

- 41 members of staff (April 2010)
  - 38 full-time permanent members
  - 1 full-time invited lecturer
  - 2 part-time invited lecturers

- 11 technical and 6 administrative staff (April 2010)

- 6 Research Units
  - 98 PhD students (31 December, 2008)
  - 29 Post-doctoral Researchers
  - 14 Junior (short term) Researchers
DEQ Today, 170 Years after the first course
III - Research Organisation (October 2008)

DEQ Today - Productivity and Quality Indicators... (I)
10 Years - 1999-2008

Scientific Production between 1999 and 2008
DEQ Today - Productivity and Quality Indicators... (II)
10 Years - 1999-2008

Number of PhD's between 2000 and 2009

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DEQ Today Productivity and Quality Indicators (III)
1st Prize Awards

EFCE Award in Industrial Crystallization, 2008 -
Modelling Crystal Growth from Pure and Impure Solutions - A Case Study on Sucrose - Dr. Pedro Martins, Professor Fernando Rocha

IChemE Awards for Innovation and Excellence 2008 - Industrial Award Winner 2008 - ABB Global Consulting Award for Sustainable Technology -
A Sustainable Process for Green Diesel Additives Synthesis - Professor Alirio Rodrigues and Dr. Viviana Silva

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http://www.fe.up.pt/deqwww
Examples of successful innovative work at DEQ-FEUP

I - New paint formulations, A. Mendes

- Cooperation with a major paint producer - CIN s.a.

Examples of successful innovative work at DEQ

II - Enriching aroma profiles, A. Mendes, L. Madeira

- New method for enriching the aroma profile of a dealcoholized beverage, particularly for producing alcohol-free beer (PT 103 657-2007; PCT/IB2008/050482)
- PhD student (Margarida Catarino) working in industrial “environment”
- Cooperation with a major beer producer - UNICER
Examples of successful innovative work at DEQ
III - New Patented Cyclone Systems
for industrial dedusting, R. Salcedo

Cooperation with a major equipment producer

Examples of successful innovative work at DEQ
IV - Development of new processes and Products -
RIMcop®pending J.C. Lopes and M. Dias

Reaction Injection Moulding with Control by Oscillation and Pulsation
Innovative process for control and design of RIM machines with simple and versatile operation.
Application example: production of multifunctional plastic parts (polyurethanes).
Examples of successful innovative work at DEQ

V - Biodiesel -
Recycling wastes to produce energy, M.C. Alvim Ferraz

Process optimization considering wastes from vegetable and animal origin as raw materials:

Waste Cooking oils
Pork Lard
Beef Tallow
Mixtures including waste incorporation

VI - Food and environmental safety, A. Alves, L. Santos

Food and environmental safety - new analytical methodologies to detect trace contaminants

- Pesticides - “home-made” microwave for sample extraction before GC or LC - MS

- Ethyl carbamate in wines - new derivatization reagent for HPLC-Fluorescence analysis (National patent)

- Mycotoxins (Ochatoxin A) - 1st worldwide interlaboratory study organized by LEPAE
Examples of successful innovative work at DEQ

VII - Hydrogen and fuel cells, A. Pinto

Demonstrative prototype - the Microborobus

- teaching Demonstration Prototype «Microborobus» with a new concept of hydrogen storage and use on-demand
- utilisation of the concept (production/storage) in practical applications coupled to fuel cells
- demonstration at Hannover Fair, «open week of FEUP», several workshops

Practical examples: production of nanostructured composites, photo-active materials, solar cells, etc.

Examples of successful innovative work at DEQ

VIII - Development of non-linear spectroscopic methods for surface analysis - J.L. Faria

Sum Frequency Generator (SFG) apparatus installed in DEQ
Examples of successful innovative work at DEQ IX - In field use of Advanced Oxidation Processes - J.L. Figueiredo and J.L. Faria

Real case examples: Nitrophenol abatement in high strength streams of an aniline production unit at CUF-QI (Estarreja)

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DEQ Today - Education

- Active participation in the Working Party on Education - EFCE
- Coordination (in collaboration with The University of Minho) of the Portuguese node on Chemical Engineering Education, of the European site:
- Participation in the European Project - CHEMPASS (2006-2009), with significant involvement of our teaching staff
  - 13 Higher Education Institutions of 9 European countries and 1 of South Africa:
    - Identification of relevant general and specific Learning Outcomes for Chemical Engineering Programmes
    - Identification of knowledge to be tested among Chemical Engineering core subjects
The Master Degree in Chemical Engineering

I - General Characterization

- Director of Studies - prof. João Campos
- We offer a First Cycle in Chemical Engineering Science and a Second Cycle in Chemical Engineering, with 300 accumulated credits ECTS, in a philosophy of integrated programmes design, characterized by:
  - Having a global profile of Chemical Engineering Science
  - Including a significant amount of laboratory and design work
  - Including activities that lead to skills and competences prescribed in the Dublin descriptors
  - Including topics and respecting guidelines of the core curriculum recommended by the WPE-EFCE
  - Being in substantial conformity with EUR-ACE criteria for second cycles

The Master Degree in Chemical Engineering

II - In the second cycle - three main specializations

- Process and Product
- Energy and Environment
- Biotechnology

- Similar structure in the 3 branches
  - Laboratory work
  - Design
  - Process control
  - H&S
  - Management
  - Electives
  - Dissertation
The Master Degree in Chemical Engineering
II - A Note about Contents (III)

- New compulsory and elective modules on relevant societal issues
  - Compulsory and optional thematic and free subjects

- Laboratory and Design work, with reference to these 300 credits:
  - Laboratory work (including Informatics) - ~40 ECTS
  - Engineering Design - 22.5 ECTS
  - Dissertation - 30 ECTS

- Out of the 238 dissertations in the last 3 academic years
  - 135 in industrial environment
  - 51 abroad in mobility programmes
  - 52 in our research labs
  \[\sim 79\%\]

The Master Degree in Chemical Engineering
Laboratories - Pilot Plant
The Master Degree in Chemical Engineering
Pilot Units available for student training (I)

- Distillation Unit offered by the Oil Refining Company - GALP s.a.

The Master Degree in Chemical Engineering
Pilot Units available for student training (II)

- Cyclone Unit for industrial dedusting, designed, built and operated by Prof. R. Salcedo and students
The Master Degree in Chemical Engineering
at the Faculty of Engineering of the University of Porto
Examples of dissertations developed together with Industry

- Radiation Control Coatings - paints for optimised management of energy consumption in buildings - with CIN SA.
- Production of vesiculated particles and its incorporation in paints - with CIN s.a.
- Development of the laboratory instrument ROBpaint for studies of rheology - with FLUIDINOVA-Barbot s.a.
- Nanoparticle development using the NETmix technology - with FLUIDINOVA s.a.
- Methods and Processes for CO2 separation by adsorption - with SYSADVANCE

The Master Degree in Chemical Engineering
Internacionalization - ERASMUS 2008/2009

Germany
- Technische Universität Berlin
- Technische Universität Dresden
- Technische Universität München
- Universität Stuttgart

Denmark
- Danmarks Tekniske Universitet

Spain
- Universitat Politècnica de Catalunya
- Universidad Complutense de Madrid
- Universidad de Santiago de Compostela

Finland
- Lappenranta University of Technology

France
- Université Claude Bernard Lyon I
- Institute National Polytechnique de Lorraine
- Université de Pau et des Pays de l’Adour
- Université de Louis Pasteur (Strasbourg I)

Greece
- Panepistimio Dytykis Makedonias
- POLYTECHNO KRITIS

Netherlands
- Technische Universiteit Delft
- Technische Universiteit Eindhoven

Poland
- Uniwersytet Marii Curie-Skłodowskiej – Wydzial Chemii

Czech Republic
- Vízoká Skola Chemicko-technologicka v Praze

Sweden
- Chalmers Tekniska Högskola
- Lund University - Lund Institute of Technology

Turkey
- Ege University
The Master Degree in Chemical Engineering
Programas Mobile and USA- 2008/2009

Mobile Programme
• Universidade de São Paulo
• Universidade Federal - Rio de Janeiro
• Universidade do Estado - Rio de Janeiro
• Universidade Federal - Santa Catarina
• Pontifícia Universidade Católica - Rio Grande do Sul
• Universidade Católica de Pernambuco
• Universidade Federal - Minas Gerais
• Universidade do Estado - Amazonas
• Universidade Estadual Campinas
• Universidade Estadual Maringá
• Universidade Estadual Paulista
• Universidade Federal - Alagoas
• Universidade Federal - Ceará
• Universidade Federal - Fluminense
• Universidade Federal - Maranhão
• Universidade Federal - Ouro Preto
• Universidade Federal - Pará
• Universidade Federal - Paraíba
• Universidade Federal - Paraná

• Universidade Federal - Pernambuco
• Universidade Federal - Rio Grande do Norte
• Universidade Federal - Rio Grande do Sul
• Universidade Federal - Santa Maria
• Universidade Federal - Uberlândia
• Universidade Regional de Blumenau
  • Fundação Armando Álvares Penteado
• Pontifícia Universidade Católica - Paraná
• Universidade de Caxias do Sul
• Universidade Regional Integrada do Alto Uruguai e das Missões

Co-operation with the USA
UMBC: University of Maryland, Baltimore County
✓ With annual video-conferences since 2002 to present the mobility programme

The Master Degree in Chemical Engineering
Internationalization - Figures on mobility

No. of undergraduate ChE students involved in mobility programmes:

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http://www.fe.up.pt/deqwww
Our Students...
Access - Nº Students - General 1st and 2nd Phases

The Department of Chemical Engineering and the Master Degree in Chemical Engineering

2nd Cycle degree diplomas awarded between 2000 and 2009

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http://www.fe.up.pt/deqwww
The Master Degree in Chemical Engineering
The Future Today, 172 Years after the first course

The future obviously exists, because...

- We are well aware of the Future...
- The subject of Chemical Engineering is vital for the progress of the Human Kind...
- We have been attracting and will keep attracting good students, the right students!

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Recognition that the reform is in its beginning
- Conformity with European developments - ‘Bologna’
- Recognition of the need for new profiles, more closely related to employability and to the new concepts of ‘professional career’
- ‘Slowly but steadily’ using new teaching/learning paradigms
  - Review subject organization and contents in a framework of Learning Outcomes based descriptors
  - Innovate in methods for achieving such Learning Outcomes

Continuous effort for improvement
- Facilities, laboratories, library resources
- Link to Industry
- Link to Alumni
- Alignment with Europe

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So, Which Future, Today in 2010, 172 Years after the first course?