Workshop - Systems, Product Development and Innovation

Undergraduate, Master’s and Doctorate Students Involved on Academic and Industrial Projects

Federal University of Santa Catarina
Technological Centre
Mechanical Engineering Department
Laboratory of Hydraulic and Pneumatic Systems

Prof. Victor Juliano De Negri
Santo André, November 13, 2015
Mechanical Engineering Department

- Founded in 1962
  - Built area: 16,000 m²
  - Expansion: 4,000 + 8,000 m²
- People (March 2014):
  - 69 full time faculty
  - 7 visiting faculty
  - 1,438 students (undergraduate and graduate)
- Research:
  - 25 Research Groups
Mechanical Engineering Department

- Undergraduate programs:
  - Mechanical engineering (1962)
  - Materials engineering (1999)

- Master’s and Doctorate Programs:
  - Mechanical Engineering (1969)
  - Materials Science and Engineering (1994)
Undergraduate Program in Mechanical Engineering

- 5 years course (4,320 hours)

Internships:
- ~40 students/semester
- 30% abroad
- 90% in industry
- 70% in Brazil
- 90% in industry

Students:
- Admission: 110/year
- Evasion: 14.9% (~16/year)

March 2014:
- Registered: 596
- Alumni: 2,878

2,878 Engineers
1962-2014
Undergraduate Program in Materials Engineering

- 5-year course (4,202 hours)

Internships:
~95 students/year
60% abroad
30% in industry
30% in Brazil
90% in industry

Students:
Admission: 70/year
Evasion: 13.8% (~10/year)

March 2014:
Registered: 355
Alumni: 463

1999-2014
463 Engineers

Not graduated
11.7%

Not graduated
2.1%

86.2%
Following some CDIO Directives

- **Standard 4 - Introduction to Engineering:**
  - 1st semester course: Introduction to engineering

- **Standard 5 - Design-Build Experiences:**
  - 6th semester course: Integrated project in mechanical engineering
    - Academic problem
    - Design following the four design phases; requirement analysis; conceptual design; embodiment design; and detailed design

- **Standard 6 - CDIO Workspaces:**
  - Hands-on courses:
    - 5th semester: Laboratory on mechanical proprieties
    - 5th semester: Laboratory on thermal sciences
    - 6th semester: Laboratory on manufacturing and metrology
ST&I Extra-Curricular Programs

Scientific & Technological Training

Industrial and Academic Projects

Junior Company

Competition Teams

Business Programs by CERTI
ST&I Extra-Curricular Programs

Industries

- Technological and Scientific Initiation
  - 285 students, 90% EMC

- Tutorial Education Program (PET)
  - 12 students, 1/3 EMC

- Business Programs (NEO - ToP) CERTI
  - 28 students, 1/3 EMC

- Competition Teams
  - 130 students, 85% EMC

- Junior Company
  - 20 students, 85% EMC

791 students

400 students EMC

50% of undergraduate students
Curricular Activities

- **Final Term Project**
  - 20 hours/week – 3 or 4 months
  - At the research groups/labs

- **Full time internships at Industry:**
  - **Mechanical Course:**
    - 1 internship of 5-6 months
    - 30% abroad (Europe, USA), being 90% in industry
    - 70% in Brazil, being 90% in industry
  - **Materials Course:**
    - 6 internships of 3 months
    - 60% abroad (Europe, USA), being 30% in industry
    - 30% in Brazil, being 90% in industry
Graduate Program in Mechanical Engineering

- Bimonthly (from 2014)
- Master’s: 18 credits + Master’s Thesis
- Doctorate: 36 credits + Qualifying Exam + Doctorate Thesis

- Master: 2 years
- Doctorate: 4 years

- POSMEC: Mechanical Engineering

- 6 Research areas

- 206 (March 2014) Students/year
- 138 (March 2014)
- 65
- 44%
- Not concluded

- 1195 M. Eng. 1969-2014
Graduate Program in Materials Engineering

2 years
- Master
  - 57 Masters (1994-2014)

4 years
- Doctorate
  - 70 Doctors (1994-2014)

3 Research areas

- Trimonthly
- 18 credits + Master’s Thesis
- 36 credits (540 h) + Qualifying Exam + Doctorate Thesis

Students/year 40

PGMAT: Materials Science and Engineering

258 Masters
102 Doctors

Not concluded
Integrated Program in Undergraduate and Master in Mechanical Engineering (ProGEM)

Undergraduate Compulsory courses

Activities at UFSC

Science, Technology, and Innovation Training Programs at UFSC

Admission ProGEM

Graduate Courses Electives for Undergrad

Final Project = Master’s thesis project

Engineering Diploma

Master’s Thesis

Industry

1ª 2ª 3ª 4ª 5ª 6ª 7ª 8ª 9ª 10ª 1ª 2ª

6 years
Research as an Integrative Activity

EMC

Masters & PhD Students
Faculty and Staff
Undergraduate Students

Research Projects

Government Agencies
External Departments & Universities
Researchers
Companies

Prototypes, Technologies
Publication
Patent, Innovation
Technology-Based Spin-offs

New frontiers

Engineers, Masters & Doctors
Interaction
University/ST&I Institute - Company

University

ST&I Institute

Funds

Cooperative Projects

Company
Interaction
University/ST&I Institute - Company

University

ST&I Institutes

Funds

Cooperative Projects

Company

Prototypes

Patents

Publications

Technology Based
Companies

R&D Departments at
Companies

Royalties
Interaction
University/ST&I Institute - Company

ST&I Institute

University

Funds

Cooperative Projects

Company

Innovative and Entrepreneur Professionals

R&D Departments at Companies

Products

Technology Based Companies
University – Industry Relationship

- University – industry relationship should start with small projects:
  - The research group learns about the industry necessities
  - The engineering group understands the potential contributions from the university
  - The difference between engineering services and technological research can be understood.

- Projects with industry provide several benefits:
  - Motivate university to research on themes of interest of the society
  - Stimulate to identify new research frontiers
  - Undergraduate and graduate students involved with actual necessities
  - Financial resources: RH payment; equipment; infrastructure
  - Non-financial resources: Components; services
  - Patents: Industrial property and royalties: *It should not be the main focus!*
University – Industry Relationship

- **Students with early engagement with industry:**
  - Internships in integral time
  - Technology and innovation programs at university with industry participation
  - Collaborative engineering programs

- **Professionals:**
  - **Engineers:** Solid and general formation in a engineering area.
  - **Master of Eng.**: Specialization on a specific field: Differential on the Brazilian industry
  - **Doctor of Eng.**:
    - Industry R&D departments: rare opportunities!
    - ST&I centers; Universities: The main target!