FACULTY OF ENGINEERING

ADDRESS Via per Monteroni, 73100 Lecce
tel. **0832/297201**; fax **0832/297203**
Web.site **www.ingegneria.unisalento.it**
Dean: **Prof. Vito Dattoma**
International Mobility Board
Faculty responsible: **Prof. Roberto Paiano**
Name e.mail **roberto.paiano@unisalento.it**
Didactic Manager **Dott. Simona D'Amato (simona.damato@unisalento.it)**
Student Services Responsible **Alessandra Russo (alessandra.russo@unisalento.it)**

Created in the academic year 1990/91, the Faculty of Engineering aims to train and produce highly qualified professionals able to set up, carry out and manage even complex design activities as well as to promote and implement innovation in different disciplinary sectors according to the educational profile.

The Faculty offers 3 three-year programs - First cycle degrees (Bachelor level) in three different profiles: Information Technology Engineering, Civil Engineering, Industrial Engineering.

INFORMATION TECHNOLOGY ENGINEERING
The degree course in Information Technology aims to provide competence in basic subjects, such as mathematics and physics, as well as in further specific studies needed in the field of Information Technology, such as Electronics, Automation and Telecommunications.

CIVIL ENGINEERING
The academic objectives of the degree course in Civil Engineering are directed towards the solving of typical problems of the field, such as design, calculation, realization, control, use, maintenance, renewal, restructuring and abandonment of civil works and infrastructures.

INDUSTRIAL ENGINEERING
The degree course in Industrial Engineering on the Lecce campus has concentrated on providing the students with a solid scientific and engineering background.
An industrial engineer must have a sound foundation, from both a theoretical and a practical point of view without neglecting a probabilistic approach in respect to a systemic one, in mathematics, physics, chemistry, the formulation of general mathematics of physical phenomena, graphical drawing of physical systems, technical-scientific subjects relative to statistics, the structure and restistance of materials, movement, and the transformation and transmission of energy.

The Faculty offers 6 two-year specialization programs- Second cycle degrees (Master Level): Civil Engineering, Mechanical Engineering, Management Engineering, Materials Engineering, Computer Engineering, Telecommunication Engineering.

CIVIL ENGINEERING
The degree course in Civil Engineering has the following objectives:
-to guarantee specific preparation through a series of courses focusing on the formation of engineers with adequate competence in advanced and innovative planning of:
foundation structures, supporting structures for civil constructions also of notable complexity and in seismic areas; .
intervention in adjustment, consolidation, and reinforcement of supporting structures of existing civil constructions;
transport systems and infrastructures, hydraulic structures for defence or the exploitation of the water supply;

-to render the students capable of critically using instruments for automatic calculation and assisted planning of civil structures and infrastructures.
-to give the students the capacity to identify and carry out interdisciplinary approaches in problem solving of the questions listed above.

MECHANICAL ENGINEERING
The degree course in Mechanical Engineering aims to create a professional figure with a deep understanding of science in general and the specific sciences needed by a mechanical engineer to be able to interpret, describe and resolve complex problems in an autonomous and innovative way, including those problems which require an interdisciplinary approach. A mechanical engineer will therefore be able to work at the highest levels in private or public enterprises, also in the European sphere, combining technical engineering understanding and capacity with organizational and coordination capabilities. The mechanical engineer will be equipped with the versatile professionalism needed to be able to deal with diverse problems, to contribute to the realization of group projects and to communicate with technicians and experts in the most diversified sectors.

MANAGEMENT ENGINEERING
The degree course in Engineering Management aims to prepare engineers capable of combining and integrating management of the technology of production and processing with the management of structures and organizational processes in the context of international competition.

MATERIALS ENGINEERING
The degree course in Materials Engineering has as its specific objective the formation of a specialist in the field of industrial materials technology (polymers, metals, ceramics, composits and biomaterial), as well as materials technology for electronics, of both inorganic and organic nature.

COMPUTER ENGINEERING
The degree course in Information Technology aims to explore the diverse applicatons for computer engineering. Thourough analysis is done of the research problems involved in the following sectors: Mainframe, software applications and information systems, high performance calculation, automation.

COMMUNICATION ENGINEERING
The degree course in Telecommunications Engineering deals with qualifying technologies and the applications of signal treatment as well as the aspects of the electronic circuit and devices of particular interest to the sector of telecommunications.

COURSES TAUGHT IN ENGLISH A.Y. 2010/11

The key role of the Engineer in the current economic-productive system makes the mission of the Faculty of Engineering challenging and difficult: in fact, it is of paramount importance to provide the student with the necessary skills that could help him/her to approach and deal with the most diverse situations that the profession implies. Additionally, engineers have been confronted with a globalized socio-economic scenario, whose level of communication is no longer limited to one language.
In such a context, our Faculty feels the duty to intervene and to form more-qualified professionals. For this reason, starting from the academic year 2010/2011, several courses are being held in English, so as to stimulate the students towards the importance of the English language as the core of their skills:

Teaching periods

- **1st semester: October 4th – February 5th 2011**
- **2nd semester: March 7th – June 18th 2011**

COURSES	1st CYCLE / 2nd CYCLE	CFU	SEMESTER	PROFESSORS	E-MAIL
System and Tehcnology for Energy	Information technology engineering (1st cycle)	6	II	Domenico Laforgia Teresa Donateo	domenico.laforgia@unisalento.it teresa.donateo@unisalento.it
Software Design Principles	Information technology engineering (1st cycle)	6	II	Luca Mainetti	luca.mainetti@unisalento.it
Innovation Management	Management engineering (2nd cycle)	9	II	Giuseppina Passiante	giuseppina.passiante@unisalento.it
Innovation Strategy	Management engineering (2nd cycle)	6	II	Giuseppina Passiante	giuseppina.passiante@unisalento.it
Intellectual Capital Management	Management engineering (2nd cycle)	6	II	Giuseppina Passiante	giuseppina.passiante@unisalento.it
Management of Capital finance instruments to Support enterprise	Management engineering (2nd cycle)	6	II	Giuseppina Passiante	giuseppina.passiante@unisalento.it
Project financial evaluation	Management engineering (2nd cycle)	6	II	Giuseppina Passiante	giuseppina.passiante@unisalento.it
Technological Entrepreneurship	Management engineering (2nd cycle)	6	II	Giuseppina Passiante	giuseppina.passiante@unisalento.it
Fluid Machinery Management	Management engineering (2nd cycle)	6	II	Paolo Carlucci	paolo.carlucci@unisalento.it

Management of Product Development	Management engineering (2nd cycle)	6	II	Alfredo Anglani	alfredo.anglani@unisalento.it
Operation Management	Management engineering (2nd cycle)	6	II	Mariagrazia Gnoni Luigi Ranieri	mariagrazia.gnoni@unisalento.it luigi.ranieri@unisalento.it
Physical Techniques for Materials Characterization	Materials engineering (2nd cycle)	6	II	Nicola Lovergine	nico.lovergine@unisalento.it
Engineering Physical Metallurgy	Materials engineering (2nd cycle)	6	II	Emanuela Cerri	emanuela.cerri@unisalento.it
Reliability for Electronics Materials and Devices	Materials engineering (2nd cycle)	6	II	Aime Lay Ekuakille Andrea Cataldo	aime.lay.ekuakille@unisalento.it andrea.cataldo@unisalento.it
Manufacturing Simulation Models	Mechanical Engineering (2nd Cycle)	3	II	Alfredo Anglani	alfredo.anglani@unisalento.it
Metal Forming Process Control	Mechanical Engineering (2nd Cycle)	3	II	Alfredo Anglani	alfredo.anglani@unisalento.it
Electrometallurgy	Mechanical Engineering (2nd Cycle)	3	I	Benedetto Bozzini	benedetto.bozzini@unisalento.it
Advanced Control Techniques	Mechanical Engineering (2nd Cycle)	9	II	Giuseppe Notarstefano	giuseppe.notarstefano@unisalento.it
Advanced Control Techniques	Computer Enginnering (2nd Cycle)	12	II	Giuseppe Notarstefano	giuseppe.notarstefano@unisalento.it
Combustion	Mechanical Engineering (2nd Cycle)	6	II	Arturo Derisi	arturo.derisi@unisalento.it
Microelectronic Design	Computer Enginnering (2nd Cycle)	9	II	Massimo Devittorio	massimo.devittorio@unisalento.it
Electronic Instrumentation for Measurements	Computer Enginnering (2nd Cycle)	9	I	Aime Lay Ekuakille Andrea Cataldo	aime.lay.ekuakille@unisalento.it andrea.cataldo@unisalento.it
Statistical Signal Processing	Communicatio n Engineering (2nd Cycle)	9	I	Giuseppe Ricci	giuseppe.ricci@unisalento.it

INFORMATION TECHNOLOGY ENGINEERING (1st cycle)

Ing – Ind / 08 System and Tehcnology for Energy

6 CFU, 2nd semester (Prof. Laforgia- Prof. Donateo)

Goals

The objectives of the course are to present a simplified treatment of applied thermodynamics within the framework of an information and communication technology curriculum and to underline the main technologies for the cooling of electronic components.

- **Applied thermodynamics and elements of fluid mechanics**

  – Review of the 1st and 2nd Law of Thermodynamics. Irreversibility and availability. Thermodynamic property relations for ideal gases. Expansion and compression of ideal gas. Hydraulic and isentropic efficiency.

  – Characteristics of Fluids. Compressibility. Isentropic relations. Speed of sound and Mach number. Compressible flows through nozzle. De Laval nozzle. Incompressible flows. Bernoulli equation. Energy losses in pipe flows. Laminar and turbulent pipe flows. Moody Diagram.

- **Heat transfer**

  – Principles of Heat transfer. Conduction, convection and radiation. Elements of heat exchangers. Principles of refrigeration and conditioning units.

  – Thermal management of electronic devices and systems.

- **Thermal and hydraulic machines**

  - Classification of Fluid Machines; Energy Transfer in Fluid Machines.

  – Pumping System and the Net Head Developed. Centrifugal pumps. Positive displacement pumps and motors. Hydraulic transmissions.

  – Working principles of dynamic and positive displacement compression units. Air fans. Performance curves.

  – Source of energy and conversion technologies. Thermodynamic cycles. Gas, steam and combined power plants. Elements of combustion. Technologies for solar and wind energy. Hydraulic power plants. Fuel cells.

  – Elements of internal combustion systems. Electronic control units.

Laboratory work

Trial on fan and pump units to determine performance curves.

References books

Y.A. Çengel, “Thermodynamic and heat tranfer”, McGraw-Hill;
John Davidson, Otto van Bertele, “Process Fan and Compressor Selection”, MEP, London;
John Davidson, Otto van Bertale, “Process Pumpt Selection”, MEP, London;
C.R. Ferguson, A.T. Kirkpatrick, “Internal combustion engines”, Wiley & Sons.

PREREQUISITE:

Laws of dynamics and kinematics. Principles of thermodynamics.

Domenico LAFORGIA
e-mail: domenico.laforgia@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7703; +39 0832 29 7781
+ 39 0832 29 7782 +39 0832 29 7779;
+39 0832 29 7780

Teresa DONATEO
e-mail: teresa.donateo@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7754

Ing–Inf / 05 Software Design Principles

6 CFU, 2nd semester (Prof. Mainetti)

The course is intended to introduce students to principles and methods in software systems design, taking into account data-oriented systems. In particular, also developing a software project, students will face the following topics: requirements analysis techniques, software architectures design techniques, architectural design patterns, software development process models; conceptual and logic data modeling, DBMSs, data definition, data manipulation, and data query languages; stand-alone, client/server, and multilevel software development frameworks and tools.

For information on syllabus of courses, on examination policies, and on office hours, please, contact directly the Professors.

LUCA MAINETTI
e-mail: luca.mainetti@unisalento.it
Facoltà di INGEGNERIA
Phone: +39 0832 29 7338
Fax: +39 0832 29 7305

MANAGEMENT ENGINEERING (2nd cycle)

Ing – Ind/35 Innovation Management

9 CFU, 2nd semester (Prof. Passiante)

Objective of the course:
Understanding the fundamentals of innovation management in order to better comprehend the current technological environment, its trends and characteristics for grasping the opportunities offered by the market.

Requirements:
A basic knowledge of business management and organization is recommended although not required.

Evaluation:
Project work evaluation and final exam

Table of contents:
- Introduction:
- The importance and impact of technological innovation

- The Sources of Innovation :
- From Creativity to Innovation
- Collaborative Networks of Innovation

- Innovation Models and Types:
- The main types of innovation
- The S Curve of Technology
- The technological life-cycles

- Conflicts of Standards and Dominant Design:
- Toward a dominant design
- The dimensions of Technology's Value (stand alone and externalities)

- The Definition of Timing for Market Entry:
- The First Mover Advantage
- The determinants of an optimal entry strategy

- Open Innovation:
- Open Innovation Approach
- Future perspectives

The project:
Weekly, individual studies and group presentations of literature contributions and case studies related to the lecture subject. Developments of contents for a wiki on the subject of innovation management.

Textbook:
- Schilling M.A., 2009, Innovation Management 2nd edition, McGraw-Hill (ch. 1, 2, 3, 4, 5)
- Chesbrough H., 2006, Open Innovation: Researching a New Paradigm, Oxford University Press (ch, 1, 10)

Giuseppina PASSIANTE
e-mail: giuseppina.passiante@unisalento.it
CENTRO CULTURA INNOVATIVA D`IMPRESA
Phone: +39 0832 29 7960
Department of Innovation Engineering
Phone: +39 0832 29 7960

Ing – Ind/35 Innovation Strategy

6 CFU, 2nd semester (Prof. ssa Passiante)

Objective of the course:
Understanding the components and factors for elaborating and implementing a successful technological innovation strategy.

Requirements:
A basic knowledge of business and innovation management is recommended although not required.

Evaluation:
Project work evaluation and final exam.

Table of contents:
- The Definition of Strategic Orientation:
- Evaluation of Competitive Positioning
- Core Competences and Capabilities

- Evaluation of Innovation Projects :
- Budget Evaluation
- Qualitative and Quantitative Methods

- Collaboration Strategy:
- The Collaborative Innovation
- The advantages of a collaborative innovation
- The partnerships

- Intellectual Property:
- Appropriability
- Trade mark, copyrights, industrial secrets etc.

- Implementing an Innovation Strategy:
- Structure and Organization of Innovation Processes
- Modularity and loosely coupled organization

- New Product Development Management:
- Methods for New Product Development (QFD, CAD, CAM)
- Team Management for Innovation
- Strategic Marketing of Innovation

The project:
Weekly, individual studies on literature contributions and case studies related to the lecture subject. Group work on implementing an innovation strategy on a concrete innovative product or service.

Textbook:
- Schilling M.A., 2009, Innovation Management 2nd edition, McGraw-Hill (ch. 6,7,8,9,10,11,12,13)

Ing – Ind/35 Intellectual Capital Management

6 CFU, 2nd semester (Prof. ssa Passiante)

Objective of the course:
Understanding the relevance and the components the Intellectual Capital, recognized as the most strategic resource for the competitiveness of current organizations, and acquiring the basic methodologies for managing and measuring it.

Requirements:
A basic knowledge of business management is recommended although not required.

Evaluation:
Project work evaluation and final exam.

Table of contents:
- The New Economy
  - Trends and foresight at the global level
  - Changes in managerial and organizational practices
- The importance of Intangibles
  - From the Industrial to the Post-Industrial Production
  - The Intengibles and their impact on competitiveness
- The Human, Organizational and Relational dimensions of Capital
  - The components of Intellectual Capital
- Intellectual Capital Managerial Tools
  - Intangibles Statement
  - Balanced Scorecard
  - Skandia Navigator
- Innovative Methodologies for Intellectual capital measurement
  - Social Network Analysis
  - Value Network Analysis
- Innovative Technological Tools for Intellectual capital measurement
  - UCINET
  - Condor
  - Pajek

The project:
Weekly, individual studies on literature contributions and case studies related to the lecture subject. Group work on the application of a selected methodology and or measurement tool in a real context to build a case Study.

Textbook:

- Lipparini A., La Gestione Strategica del Capitale Intellettuale, Ed. Il Mulino, Milano 2002.
- Stewart T. A., Il Capitale Intellettuale: la nuova ricchezza, Ponte alle Grazie, Milano 1999
- Teece, D. J. *Managing Intellectual Capital*, Oxford University Press, 2000

Ing – Ind/35 Management of Capital finance instruments to support enterprise

6 CFU, 2nd semester (Prof. ssa Passiante)

TEACHING COURSE OBJECTIVES

- The course is intended to:
  - provide guidelines and practical tools for the knowledge of public funding opportunities;
  - develop specific skills in the field of funding instruments for supporting economical needs of SMEs;
  - analyze technical and economical characteristics of different public sources of funding in the field of concessional financProf.

SYLLABUS Theoretical contents

- **Main typologies of European Community funding opportunities**

Recent policies for supporting development;
The financial incentive system and related relationship with national and local opportunities;
European funding instruments (EIB, EIF);
Indirect support plans for enterprises;
Structural funds (ERDF, ESF, EAGGF, EFF);
Community Initiative Programme;
European Union support programmes for SMEs.

- **Modalities and procedures for accessing sources of funding**

Preliminary evaluations for accessing concessional financing and incentives;
Methodological and operating guidelines;
Analysis of intervention typologies;
Calls for proposal, invitations and direct requests.

- **Drafting a Business Plan to be applied for funding**

Business Plan definitions and contents;
Project presentation;
Business Plan financial data;
Timelines of investments and funding;
Financial flow forecasting (balance sheet)

- **From the project acceptance to the final financial statement**

Modalities of funding grants;
Final verification of accountancies;
Motives of total and partial funding countermand.

Practical contents and case-studies

- The choice of funding opportunity: theoretical and operating issues;
- Drafting of a strategic financial plan;
- Case-studies of real realized interventions.

Ing – Ind/35 Project financial evaluation

6 CFU, 2nd semester (Prof. Passiante)

Objective of the course:

Understanding the financial dynamics behind an investment project in the context of the corporate finance framework (management, shareholders, bondholders, society). Apply the toolset of corporate finance to evaluate and finance investment projects.

Requirements:

A basic knowledge of business management and organization is recommended although not required.

Evaluation:

Project and interview

Table of contents:

- The financial environment and corporate finance:
  The financial environment
  Firms as parts of the financial environment
  The objective funcion of a firm
  The principles of corporate finance

- Investment decision:
  measuring risk and the hurdle rate of return of an investment project: calculating the weighted average cost of capital
  measuring the returns of an investment project: basic principles of financial decision-making
  synergies, side effects and real options

- Financing decision:
  the main sources of financing projects and firms: debt, equity and hybrids securities
  reaching the optimal financial structure
  financial engineering: how to build securities to match the financing needs of a project

- Dividend decision:
  investing vs. dividends: how to evaluate firm's dividend policy. The role of cash flows and alternative investment opportunities

The project:

- Financial analisys of an investment project:

  The project involves the evaluation of an investment project under the framework of the financial policy of a firm.

Textbook:

· Damodaran A., Applied Corporate Finance 3rd edition, Wiley (ch. 1, 2, 3, 4, 5,.6, 7, 8, 9, 11)

Ing – Ind/35 Technological Entrepreneurship

6 CFU, 2nd semester (Prof. Passiante)

Objective of the course:

- Introduce the subject of entrepreneurship to scientists and engineers geared around their unique perspective.
- Examine the core topics of commercialization, opportunity, starting a company and building an effective team.
- Understand the development and protection of intellectual property and consider patents, trademarks, copyrights, trade secrets and licensing of intellectual property as a commercialization strategy.
- Examine the critical aspects of strategy, from product development to market entry strategies, technology adoption patterns and their associated marketing strategies.
- Become familiar with financial strategy, funding of technology start-ups, funding of growing technology companies and technology valuation.

Requirements:

A basic knowledge of business management is recommended although not required.

Evaluation:

Project work evaluation and final exam.

Main contents:

- Scientists and Engineers as Entrepreneurs
- Recognizing and Screening Technology Opportunities
- Designing and Developing a Technology Start-up
- Building an Effective Team
- The Concept of Intellectual Property
- High Technology Product Development Strategies
- Technology Transition and Entry Strategies
- Technology Adoption Patterns and Marketing Strategy
- The Business Model
- Funding the Technology Start-up
- Funding Growth
- Technology Valuation
- Presentation and delivery of Final Project

The project: ***Opportunity Analysis and High Tech Entrepreneurial business development***

This assignment tests the teams ability to gather useful knowledge and creatively apply it to a new business opportunity. It's fundamental to understand the contexts of what is going on in industrial environments: what are the driving forces; who are the key players; how do they get things done; what are likely competitive responses to new threats, etc. This knowledge forms the basis for determining new opportunities that exist in the competitive space.

The project requires a team of students to analyze and identify opportunities within an industry segment or sector. The process differs from a customary feasibility analysis or business planning exercise. A more traditional entrepreneurial exercise is to identify a "great idea" through brainstorming and then write a feasibility analysis or business plan to evaluate that idea and its viability.

The final deliverable for this assignment is a list of potential opportunities and the development of the business model for at least one of these opportunities. The student need to complete a full feasibility analysis or business plan and should be able to conceptualize the steps you required to undertake in order to capitalize upon this opportunity .

Textbook:

Allen, K. (2009), **Entrepreneurship for Scientists and Engineers.** Upper Saddle River, New Jersey, Pearson Prentice Hall.

Ing – Ind/ 09 Fluid Machinery Management

6 CFU, 2nd semester (Prof. Carlucci)

For information on syllabus of courses, on examination policies, and on office hours, please, contact directly the Professor:

Antonio Paolo CARLUCCI
e-mail: paolo.carlucci@unisalento.it
Dipartimento di Ingegneria dell'Innovazione
Phone: +39 0832 29 7751

Ing – Ind/16 Management of Product Development

6 CFU, 2nd semester (Prof. Anglani)

For information on syllabus of courses, on examination policies, and on office hours, please, contact directly the Professor:

Alfredo ANGLANI
e-mail: alfredo.anglani@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7232; +39 0832 29 7380

Ing –Ind/17 Operation Management

6 CFU, 2nd semester (Prof. Gnoni, Prof. Ranieri)

For information on syllabus of courses, on examination policies, and on office hours, please, contact directly the Professors:

Maria Grazia Gnoni
e-mail: mariagrazia.gnoni@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7366

Luigi Ranieri
e-mail: luigi.ranieri@unisalento.it
Department of Innovation Engineering

MATERIALS ENGINEERING (2nd cycle)

Fis / 03 Physical Techniques for Materials Characterization

6 CFU, 2nd semester (Prof. Lovergine)

The Course topics deal with physical analysis techniques for materials characterization to an introductory level apt for 2nd level students in materials engineering. The aim is to provide a basic knowledge about the fundamental physical concepts, the experimental methodologies and related instrumentations used in the physical-chemical (structural, morphological, compositional, etc.) characterisation methods, as applied to various areas of materials science and engineering. Besides, the Course will provide extensive examples of applications to various types of materials (i.e., metals, semiconductors, organic materials, etc.), along with laboratory classes focussing on the practical use of the different instrumentations and tools for modern analysis/characterisation of materials.

Introduction: objective, contents and methodology.
Overview on the various materials analysis techniques.
X–Ray Fluorescence (XRF).
Techniques based on electron beams.
X-Photoelectron Spectroscopy (XPS or ESCA).
Auger electron Spectroscopy (AES).
Applications of XPS and AES techniques.
Scanning Electron Microscopy (SEM).
Electron Microprobe Analysis (EMA) for elements identification and quantitative analysis of elemental composition.
Energy Dispersive Spectroscopy (EDS) using a solid state detector.
Applications of the different techniques.
Secondary Ion Mass Spectroscopy (SIMS); sputter depth elemental profiles.
Laboratory experiments:

- X-Ray wavelength dispersion experiments using the XRD diffractometer of the Dept. of Innovation Engineering (DII);
- Observations at the SEM of DII;
- Microanalysis experiments on the SEM microscope of the Physics Dept.

Textbooks and didactical materials:

- Terry L. Alford, L. C. Feldman, James W. Mayer, *Fundamentals of Nanoscale Film Analysis*, 330 pages, Springer-Verlag New York Inc. (Oct 2006)
- Teacher's notes.

Examination Schedule

Monday 20th June 2011 at 3.00 p.m.
Wednesday 20th July 2011 at 3.00 p.m.

Nicola LOVERGINE
e-mail: nico.lovergine@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7250

Ing – Ind/21 Engineering Physical Metallurgy

6 CFU, 2nd semester (Prof. ssa Cerri)

Engineering Physical Metallurgy

Phase diagrams and ternary equilibrium. Computation of phase diagrams.
Diffusion in ternary alloys and in multiphase binary systems. The strengthening of Iron and its alloys
Crystal interfaces and microstructure.
Diffusionless transformations in metals: characteristics, Martensite crystallography, martensite growth, tempering of ferrous martensite. Case studies.
Diffusional Transformations in Metals and Alloys and case studies: titatium forging alloys, weldability of low carbon and microalloyed rolled steels, very low-Carbon Bainitic steel, very fine bainite.
Theoretical background of mechanical properties.
The stereographic projection. Microstructure determination: X-Rays Diffraction, Scanning Electron Microscope, Transmission Electron Microscope. Residual stress measurements by X-Rays and texture determination in metals.

Textbooks

D.A. Porter, K.E. Easterling, M.Y. Sherif, Phase transformations in Metals and Alloys, 3rd edition, (2009) CRC Press
M. Tisza, Physical Metallurgy for Engineers, ASM Int. (2001)
J.D. Verhoeven, Fundamentals of Physical Metallurgy, Wiley (1989)

Emanuela CERRI
e-mail: emanuela.cerri@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7324; +39 0832 29 7344

Ing – Inf/07 Reliability for Electronics Materials and Devices

6 CFU, 2nd semester (Prof. Lay-Ekuakille, Prof. Cataldo)

Objectives

The main objective of the course is to delivery basic concepts of reliability and quality assurance for electronic materials and devices. Characterization techniques of materials and devices play a key role during the course. Electrical safety issues are also delivered.

Programme

- Qualification CE, Calibration centers, SINCERT system.
- QA. ISO 9001-2000, ISO 9001-2008 outlines
- Introduction to Reliability. Basic concepts and history, quality and failures basics. Reliability function, experimental distribution, reliability parameters.
- Reliability theory. Hazard models (failure rate). Mission reliability. Analytical concepts.
- Combinational reliability – tests on components and systems. Configurations, system MTTF, Complex configuration. Life tests, degradation models, accelerated life tests, step tests, conformity tests, reliability determination, test conditions, test cycles, failure analysis.
- Statistics on reliability. Distributions, punctual assessment, assumption verification, statistical sampling.
- Techniques for increasing reliability. Actions on projects, actions on components, redundancy, maintenance, pre-conditioning.
- Examples. Opto-electronic components, power devices, failure analysis and technological characterization, data quality and reliability applied to industry.

Laboratory exercises

Lab activities are envisaged. The plan and the list of exercises will be defined at the beginning of the course.

Main references

ISO: UNI EN ISO 9000-1, UNI EN ISO 9004-1, UNI EN ISO 9001
Nelson W., Accelerated testing, Ed. J. Wiley & Sons, New York, 1990
Amerasereka E.A., Campbell D.S., Failure Mechanisms in Semiconductor Devices, J. Wiley & Sons, New York, 1987

Aime LAY EKUAKILLE
e-mail: aime.lay.ekuakille@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7352

Andrea Maria CATALDO
e-mail: andrea.cataldo@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7823

MECHANICAL ENGINEERING (2nd cycle)

Ind/16 Manufacturing Simulation Models

3 CFU, 2nd semester (Prof. Anglani)

Introduction

In the manufacturing field, discrete event simulation is a well-known tool to efficiently find solutions. Typical application areas are: design of new plants, process improvement, cost reduction and production planning. Simulation provides an inexpensive, low-risk way to test changes ranging from a simple revision to an existing production line to emulation of a new control system or redesign the whole supply chain. Simulation can accurately predict system behavior under changed conditions and reduce the risk of making bad decision.

Objectives

This course provides an introduction to system modelling using both computer simulation and mathematical techniques. Different case studies are examined. The emphasis is on the analysis of manufacturing systems using a combination discrete-event simulation and modelling paradigms such as queueing theory.

Contents

- Introduction and basic simulation procedures.
- Model classification: Monte Carlo, simulation, discrete-event simulation, continuous, mixed continuous/discrete-event simulation.
- Quantitative modelling paradigms: queueing networks, Mean Value Analysis
- Input and output analysis: random numbers, generating and analysing random numbers, sample generation, trace- and execution-driven simulation, point and interval estimation.

Learning Outcomes

Students will be able to analyse manufacturing systems through case studies, lectures and tutorial exercises. They will also be able to demonstrate an understanding of system modelling through the competent use of Computer Simulation methods and Mathematical Modelling techniques

Alfredo ANGLANI
e-mail: alfredo.anglani@unisalento.it
Department of Innovation Engineering
Tel: +39 0832 29 7232; +39 0832 29 7380

Ing – Ind/16 Metal Forming Process Control

3 CFU, 2nd semester (Prof. Anglani)

Overview

This course provides the basics of the various metal forming processes including: changes of materials properties after forming, their formability, mechanics of forming processes, calculation of forming forces, forming defects (springback, wrinkles, fracture, work hardening, residual stress), causes and solutions to overcome them.
The objectives of the course are:

1. Gain a theoretical fundamental of materials formability and various forming processes.
2. Learn techniques for continuous process and quality improvement.
3. Study causes of forming defects and apply solutions to improve parts quality.

Arguments

- **Description of the sheet metal forming processes**

- Introduction to the sheet metal DEEP DRAWING (DD) process.
- Introduction to non conventional sheet metal forming processes: hydroforming (hydroforming with a membrane diaphragm (flexforming); hydromechanical deep drawing; hydraulic deep drawing; active hydromechanical deep drawing, double blank hydroforming); flexforming; rubber pad forming (Guerin process and Marforming). Advantage and disadvantage between different metal forming processes.
- Examples and industrial applications.

- **Available components typology characterization**

Processes and workpiece characterization based on:

- Geometry,
- Material,
- Forming process.

Responses evaluation and DESIGN SPACE (DS), PROCESS WINDOW (PW) AND FEASIBILITY WINDOW (FW).

Sheet metal forming process analysis

Definition of the process parameters and process simulation set-up with CAE tools. Evaluation of the responses and product quality assessment with CAE tools and nondestructive and destructive inspection methods. Process optimization that is function of process parameter and the correspondent variability of the responses. Process mapping and best practice rules definition for good process design.

Non conventional sheet metal forming process analysis

Definition of the process parameters and process simulation set-up with CAE tools. Evaluation of the responses and product quality assessment. Process optimization that is function of process parameter and the correspondent variability of the responses. Numerical and experimental correlation of hydromechanical deep drawing process. Process mapping and best practice rules definition for good process design.

Alfredo ANGLANI
e-mail: alfredo.anglani@unisalento.it
Department of Innovation Engineering
Tel: +39 0832 29 7232; +39 0832 29 7380

Ing – Ind/23 Electrometallurgy

3 CFU, 1st semester (Prof. Bozzini)

PROGRAM

- Definition, principles and concepts
  - Basic facts
  - Self-driving cells
  - Electrolysis
  - Electrocrystallisation

- Surface morphology of metal electrodeposits
  - Thin compact metal films
  - Thick compact metal films
  - Disperse deposits and powder production
  - Template-based processes

- Current distribution
  -Plane-parallel electrodes
  - Cells with low anode polarisation
  - Corner-problems

- Electroplating and surface finishing
  - Electrodeposition of alloys
  - Electroplating from non-aqueous solvents (organic solvents, ionic liquids, molten salts)
  -Electrochemical oxidation of metals

- Electrochemical metal-working and metal-forming technolgies
  - Electromachining and electroerosion
  - Electroforming
  - Electropolishing
  - Electrodeposition of composits
  - Electrowinning
  - Electrorefining
  - Pulse-plating
  - Electroless deposition

Literature

K.I. Popov, S.S. Djokic, B.N. Grgur
"Fundamental Aspects of Electrometallurgy"
Kluwer Academic, NY, 2002

Examination Schedule

Date	Time	Location
20/062011	PM 3 10	
01/07/2011	PM 310	

Benedetto BOZZINI
e-mail: benedetto.bozzini@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7621; +39 0832 29 7344

Ing – Inf/04 Advanced Control Techniques

9 CFU, 2nd semester (Prof. Notarstefano)

- **Prerequisites**

Mathematical Analysis, Physics (Mechanics) and foundations of automatic control theory are required. Analytical Mechanics background is a plus. IMPORTANT: Students are invited to contact the professor if they do not have some of the prerequisites but still are interested in the course**.**

- **Objectives**

The first course objective is to provide control methodologies to analyze structural properties of nonlinear dynamical systems and to design control strategies for aggressive maneuvering. Preliminary analysis and design tools for cooperative control of multi-agent systems will be also provided. The second objective is to bridge the gap between theory and applications by applying the studied techniques to simplified (Matlab) models of real systems, mainly (aerial and car) vehicles and other mechanical systems.

- **Evaluation**

Project + homework + discussion

- **Course description**

In this course we will mainly focus on dynamical systems that can be represented as nonlinear (possibly time-varying) ordinary differential equations. In the first part of the course we will investigate analysis tools to characterize structural properties of nonlinear systems as stability, controllability and maneuverability. In the second part, we will focus on selected design tools to perform aggressive maneuvering of nonlinear systems. The proposed techniques will be applied to a number of example domains, including robotics, avionics (thrust-vectored aircrafts and UAVs), and automotive (car models). The third part of the course will focus on a novel class of dynamical systems, namely multi-agent systems. Multi-agent systems consists of many control systems that aim at performing global tasks via local communication in a cooperative way. The main challenges of cooperative control will be identified and preliminary communication and control techniques will be presented.

- **Course References**

The course is based on a set of articles which will be made available throughout the term.

- **Recommended books**

- H. K. Khalil. Nonlinear Systems, 3rd Edition. Prentice-Hall, 2002.
- Isidori, Nonlinear control systems, Springer
- A Mathematical Introduction to Robotic Manipulation - Richard M. Murray, Zexiang Li, S. Shankar Sastry.
- Distributed Control of Robotic Networks - Francesco Bullo, Jorge Cortes, Sonia Martinez

Giuseppe NOTARSTEFANO
e-mail: giuseppe.notarstefano@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7360

Ing – Ind/09 Combustion

6 CFU, 2nd semester (Prof. Derisi)

Combustion

- Chemical Thermodynamics and Flame Temperatures
- Chemical Kinetics
- Explosive and General Oxidative Characteristics of Fuels
- Flame Phenomena in Premixed Combustion Gases
- Detonation
- Diffusion flames
- Ignition
- Environmental Combustion Considerations
- Combustion in engines

Reference book:

- Irvin Glassman, "Combustion", , Academic Press, San Diego, California
- C.R. Ferguson, A.T. Kirkpatrick, "Internal combustion engines", Wiley & Sons

Arturo Antonio DE RISI
e-mail: arturo.derisi@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7756; +39 0832 29 7757

COMPUTER ENGINNERING (2nd cycle)

Ing – Inf/01 Microelectronic Design

9 CFU, 2nd semester (Prof. De Vittorio)

Goals of the course:

Know how acquisition of analysis and design of analog integrated circuit blocks.

Requirements:

Good knoledge of basic electronics. No prerequisites.

Exam mode:

Oral

Program:

Theory

- The operational amplifier (Opamp)
  Topics:
  - Basic stages: common source, common drain and common gate amplifier.
  - MOS differential couple
  - Two stages CMOS opamp
  - Feedback
  - Opamp compensation
  - Folded Cascode opamp
  -Fully differential opamp
  -Common mode feedback circuit
- The comparator
  Topics:
  -The opamp as comparator
  -Latched comparators
  -Examples of CMOS comparators
- Continuous time analog filters
  Topics:
  - Transfer function, types and specifications
  - Fundamental parameters: Total Harmonic Distortion, in-band and out-of-band IIP3 noise, and Noise Figure
  - Active RC filters
  - Gm-C Filters
  - Examples of design
- Low-power low voltage design
  Topics:
  - The technology evolution
  - Circuit techniques for the low-voltage design
  - Low-voltage low power analog systems
  - Design examples
- Use of Cadence
  - Schematic design
  -Simulations setting: DC analysis, frequency response, noise analysis, transient analysys, worst cases
  - Design of the layout and parasitic extractions
- Calculator assisted exercises
  The exercise include the use of the design tools (Cadence, Mentor) most commonly used in the industry and in the Research centers. The devices studied during the course will be designed both at transistors and layout level. Therefore, the design flow will be completed.
  Design
  At the end of the course a report on the assigned design will be delivered. The design include both transistors and layout level design of analog circuit blocks.

Suggested books:

- David A. Johns, Ken Martin "Microelectronics Circuits" John Wiley and Sons.
- Adel S. Sedra, Kenneth C. Smith "Cicuiti per la Microelettronica" Edises

Notes of the course.

Examination Schedule

Date	Time	Location
07/02/2011	AM 10	
21/02/2011	AM 10	
20/06/2011	AM 10	
04/06/2011	AM 10	

Massimo DE VITTORIO
e-mail: massimo.devittorio@unisalento.it
Scuola Superiore ISUFI
Phone: +39 0832 29 8200

Ing – Inf/04 Advanced Control Techniques

12 CFU**,** 2nd semester (Prof. Notarstefano)

- **Prerequisites**

Mathematical Analysis, Physics (Mechanics) and foundations of automatic control theory are required. Analytical Mechanics background is a plus. IMPORTANT: Students are invited to contact the professor if they do not have some of the prerequisites but still are interested in the course**.**

- **Objectives**

The first course objective is to provide control methodologies to analyze structural properties of nonlinear dynamical systems and to design control strategies for aggressive maneuvering. Preliminary analysis and design tools for cooperative control of multi-agent systems will be also provided. The second objective is to bridge the gap between theory and applications by applying the studied techniques to simplified (Matlab) models of real systems, mainly (aerial and car) vehicles and other mechanical systems.

- **Evaluation**

Project + homework + discussion

- **Course description**

In this course we will mainly focus on dynamical systems that can be represented as nonlinear (possibly time-varying) ordinary differential equations. In the first part of the course we will investigate analysis tools to characterize structural properties of nonlinear systems as stability, controllability and maneuverability. In the second part, we will focus on selected design tools to perform aggressive maneuvering of nonlinear systems. The proposed techniques will be applied to a number of example domains, including robotics, avionics (thrust-vectored aircrafts and UAVs), and automotive (car models). The third part of the course will focus on a novel class of dynamical systems, namely multi-agent systems. Multi-agent systems consists of many control systems that aim at performing global tasks via local communication in a cooperative way. The main challenges of cooperative control will be identified and preliminary communication and control techniques will be presented.

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Giuseppe NOTARSTEFANO
e-mail: giuseppe.notarstefano@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7360

Ing – Inf/07 Electronic Instrumentation for Measurements

9 CFU, 1st semester (Prof. Lay-Ekuakille, Prof. Cataldo)

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Objectives

The tuition intends to deliver general and dedicated aspects of electronic architecture applied to measurements. Design and characterization of architecture are also included. The students also will study, in a deep way, specific measurement instruments.

Programme

1. **General chain/loop of measurements**.
2. **Sensors and transducers.** Advanced concepts and characterization. Requirements and specifications
3. **Conditioning circuits.** Design and characterization.
4. **ADCs and DACs.** Performances.
5. **Noise.** Basics, characterization and filtering. Circuitry.
6. **Instrumentation**. Waveform generators, advanced and complex oscilloscopes, logic analyzer, digital open instrumentation.
7. **Virtual instrumentation.** Labview environment.
8. **Architectural design.** Use of microcontrollers, DIAC, TRIAC, electronic regulators and other components for instrumentation.
9. **Experimentation design and advanced statistical methods**

Laboratory exercises

Design of open architecture for instrumentation and measurements. Labview exercises. Specific measurements. Circuitry construction. Sensor and transducer *application.*

Main references

W. Nawrocki, Measurement systems and sensors, Artech House 2005

T.H. O'Deil, Circuits for electronic instrumentation, Cambridge University Press, 1991

S. Wolf, Richard F.M. Smith, Student Reference Manual for Electronic Instrumentation Laboratories, Pearson Prentice Hall, 2005

J.W. Dally, W.F. Riley, K.G. McConnell, Instrumentation for Engineering Measurements, J. Wiley & Sons, 1993

Aime LAY EKUAKILLE
e-mail: aime.lay.ekuakille@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7352

Andrea Maria CATALDO
e-mail: andrea.cataldo@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7823

COMMUNICATION ENGINEERING (2nd cycle)

Ing – Inf/03 Statistical Signal Processing

9 CFU, 1st semester (Prof. Ricci)

For information on syllabus of courses, on examination policies, and on office hours, please, contact directly the Professors.

Giuseppe Ricci
e-mail: giuseppe.ricci@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7205; +39 0832 29 7306

Ing – Inf/04 Advanced Control Techniques

9 CFU, 2nd semester (Prof. De Notarstefano)

- **Prerequisites**

Mathematical Analysis, Physics (Mechanics) and foundations of automatic control theory are required. Analytical Mechanics background is a plus. IMPORTANT: Students are invited to contact the professor if they do not have some of the prerequisites but still are interested in the course**.**

- **Objectives**

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- **Evaluation**

Project + homework + discussion

- **Course description**

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Giuseppe NOTARSTEFANO
e-mail: giuseppe.notarstefano@unisalento.it
Department of Innovation Engineering
Phone: +39 0832 29 7360