Offerta didattica della Scuola di Dottorato del Politecnico di Bari nel XXXVI ciclo

Di seguito si riporta l'elenco delle discipline attualmente approvate dalla Scuola di Dottorato (SCUDO) del Politecnico di Bari nell'ambito dell'offerta didattica del XXXVI ciclo (A. A. 2020-2021).

Gli studenti di Dottorato di Ricerca iscritti ad uno qualsiasi dei 6 corsi di dottorato del Politecnico di Bari ("Industria 4.0", "Ingegneria meccanica e gestionale", "Ingegneria elettrica e dell'informazione", "Rischio, sviluppo ambientale, territoriale ed edilizio", "Conoscenza e innovazione nel progetto per il patrimonio", "Ingegneria e scienze aerospaziali") possono seguire qualsiasi (una o più) tra le successive discipline, conseguendo i relativi CFU a seguito di superamento del corrispondente esame.

1. **Conservation Laws in Continuum Mechanics and Traffic Modeling, 2 CFU, SSD: MAT/05.**

Syllabus:
Introduction to Conservation Laws. Scalar conservation laws. Hyperbolic systems of conservation laws. Euler and Burgers equations. The Method of Characteristics. Semilinear equations with constant coefficients. Semilinear equations with variable coefficients. Quasilinear equations: creation of shock waves. Shock waves. Discontinuous solutions. Rankine-Hugoniot conditions. Shock waves. Entropies and entropy fluxes for scalar equations and systems. Entropy weak solutions. Liu conditions: entropic shock waves. Kruzkhov Theorem. Uniqueness and stability of entropy weak solutions. Change of coordinates. Oleinik Estimate. Oleinik estimate for conservation laws with convex fluxes. Uniqueness via Oleinik type estimates. Riemann Problem. Shock and rarefaction waves. Solution of the Riemann problem for convex fluxes. Solution of the Riemann problem for general fluxes. Vanishing Viscosity. Vanishing viscosity approximants. Viscous shock waves. Convergence and error estimate. Numerical schemes. Viscosity solutions for Hamilton-Jacobi equations. Legendre transform. Lax-Oleinik Formula. Traffic Models. Fluid-dynamic models for vehicular traffic. LWR model: shock and rarefaction waves. Aw-Rascle model. Two phase models. Multi-population models. Traffic on networks: shocks generated by the junctions. Continuum Mechanics. Nonlinear elasticity. Gas dynamics. The p-system. Shock waves. Riemann invariants.

2. **Introduction to PDEs and Applications, 2 CFU, SSD: MAT/05.**

Syllabus:
<u>Preliminary Calculus tools</u>

- Differential Calculus
- Function sequences and function series
    - Taylor Series
    - Power Series
    - Fourier Series

<u>Partial Differential Equations</u>

- Transport Equation
    - Physical model
    - Solving the initial value problem
    - Transport equation with damping
    - Transport equation with concentrated source
- Heat Equation
    - Linear diffusion model
    - Separation variables

    - Maximum principle
- Laplace Equation
    - Harmonic functions
    - Separation variables
    - Maximum principle
- Wave Equation
    - d'Alembert's formula
    - Vibrating string

3. **Statistical Mechanics with Applications to Materials Science, 2 CFU, SSD: MAT/07.**

Syllabus:
Introduction To Statistical Mechanics: Thermodynamics; equations of state; free energy and entropy; observables; ensembles; probability distribution; partition function in the canonical ensemble.
Phase Transitions: Ensembles of phase transitions; critical points; correlation functions; symmetry breaking and order parameter; Landau theory and mean field.
Models: Ising model: solution in one and two dimensions; Heisenberg model; random ferromagnets; polymers; liquid crystals.

4. **Proportional and servo-valves: industrial state-of-the-art and research advancements, 2 CFU, SSD: ING-IND/08.**

Syllabus:
This course will allow PhD students to improve their technical knowledge of Fluid Power, particularly of directional proportional valves and servo-valves, which are widely used in several industrial and aeronautical control systems demanding high precision and repeatability.
At the beginning, the course will briefly deal with the operating principles of volumetric pumps, volumetric motors and cylinders. Analytical formulas used to study these components will be introduced as well. Afterwards, the architectures of directional proportional valves and servo-valves will be described thoroughly. The implementation of these components into hydraulic systems employing volumetric pumps, volumetric motors and cylinders will be discussed in detail. Analytical formulas allowing the calculation of the flow rate, discharge coefficients, flow forces, etc., will be explained too. The students will also be introduced to advanced numerical simulation tools applied to these valves, such as Ansys Fluent and Simscape Fluids, and advanced experimental testing procedures used in industry and academia. Finally, current research investigations into these components will be presented, in particular research studies dealing with the fluid-dynamic optimization of proportional valves, cavitation in proportional valves, internal leakage in the main stage of servo-valves, squeeze film damping mechanism in the pilot stage of servo-valves, and novel servo-valve concepts using piezo-actuators.

5. **Numerical Approaches to Solid and Applied Mechanics: Boundary Element Methods (BEM), 2 CFU, SSD: ING-IND/13.**

Syllabus:
Theory of BEM (6 hours). Linearity and superposition principle: integral formulation of mechanical problems. Green's function. Translation Invariance. Solution schemes of the integral convolution: Fourier vs Real space. Adaptive mesh.
BEM Applications: Contact Mechanics (6 hours). BE methods for contact mechanics: formulation for linear elastic and viscoelastic materials, role of the geometric domain (smooth and rough contacts), meshing and solution schemes.Boundary Element (BE) vs Finite Element (FE) methodologies: advantages and drawbacks.

Coupling BEM And Other Numerical Methods (4 hours).Numerical coupling to study finite domains: BEM and FEM; BEM and molecular dynamics (MD). The case of soft lubrication: coupling BEM and finite difference (FD).
BEM Applications: Structural Mechanics (4 hours). BEM for modal analysis including fluid-structure interaction: the test case of the modal analysis for a beam immersed in a viscous fluid.

6. **Application of Thermographic techniques to general problems in Mechanical Engineering, 2 CFU, SSD: ING-IND/14.**

Syllabus:
1.Review of measurement of temperature related problems (2 hours): a. Contact measurements; b. Non contact measurement: pyrometers; c. Non contact measurement: Thermal cameras.
2. Performing Thermal measurements (6 hours): a. Instrumentations; b. Setup; c. Reflected temperature and emissivity issues.
3. Applications: a. Thermal methods in on Destructive testing (6 hours); b. Thermal methods applied in wind gallery (2 hours); c. Thermal methods for process monitoring (2 hours); d. Thermal methods for welding monitoring (2 hours).
Individual guided implementation of a typical setup for thermographic measurement

7. **The Industry 4.0 Operator - Improving the Human Performance Envelope - Tools and Methods, 2 CFU, SSD: ING-IND/15.**

Syllabus:
The course will be composed of 3 modulesaimingat providing Ph.D. students with the necessary knowledge to validate in their scientific research the effectiveness of solutions designed in order to improve the operator's performance with particular attention to the HPE.
Module I. Introduction and theoretical bases.The role of the Operator in the I4.0 smart factory. Introductionto the concept of HPE and its fundamental components —the physical and the cognitive workload.Basic principles of the Cognitive Load Theory.The ISO standard 11226 Ergonomics — Evaluation of static working postures.
Module II. Assessment methods for physicalergonomics. Post-hoc measures (the Borg-CR 10 scale), direct methods, observational methods(the Rapid Upper Limb Assessment metrics), innovative applications for the observational methods (the ErgoSentinel tool).
Module III. Assessment tools for cognitive ergonomics.Post-hoc measures (the NASA Task Load Index, the Multiple Resource Questionnaire), task performance measures (Completion time, Error Rate, reaction Time, the dual-task design); direct methods (the electrocardiographic signal and the Heart Rate Variability Analysis approach).

8. **Innovative Materials and Processes for Large Science Experiments, 2 CFU, SSD: ING-IND/16.**

Syllabus:
This multidisciplinary course intends to present new, relevant, and advanced topics within innovative materials science and engineering. This course explores the exiting relationships between the performance of mechanical, electrical, optical, and magnetic devices, and the material/technological characteristics used to construct them. Moreover, the design of the experiments and the development of real options are investigated to evaluate design flexibility. Emphasis is placed on evaluating real options with special attention given to efficient analysis and practical applications.

9. **Lean Production in the Digital Factory, 2 CFU, SSD: ING-IND/17.**

Syllabus:
1. Lean Production Elements (1 CFU).
Leanprinciples and Lean approach.

Quantitative methods for Cycle time analysis and losses evaluation in production systems.
Value Stream Mapping and Value Stream Design.
2. Continuous improvement of system performance (0,5 CFU).
Performance Measurement System (PMS).
Tree-like structure of Key Performance Indicators (KPIs) for manufacturing operations management (MOM).
IEC and ISO Standards for the digital factory.
3. Lean processes and the digital factory (0,5 CFU).
Lean Transformation: from Toyota Production System (TPS) to Industry 4.0.
Emerging Standards for data acquisition and data processing, Machine to machine communication (M2M), and Human-machine interaction (HMI).

10. Technology Entrepreneurship: Theory & Practice, 2 CFU, SSD: ING-IND/35.

Syllabus:
The present course aims at allowing PhD students to develop the ability for identifying and evaluating technology opportunities with commercial exploitation potential. Indeed, the course is designed to make PhD students able to understand the main arguments for translating their research outcomes into business ideas. Specific attention will be paid to the evaluation and definition of new technology-based business ideas, providing the students with theoretical and practical insights. Three main arguments will be discussed, as:
A) Business Modeling – this section aims at providing PhD students with the fundamental strategic and managerial issues of business evaluation, modeling, and definition, hence making them able to translate research ideas into business opportunities. Lessons will be based upon theory and actual cases' discussion.
B) Innovation Management– this section aims at providing PhD students with the basic concepts and methodologies to understand and analyze the strategic processes of firm's technological innovation in the attempt to make them able to manage innovation processes for generating and sustaining competitiveness. Particular attention will be paid to first mover advantage, collaboration strategies, intellectual property protection, and open innovation. Lessons will be based upon theory and actual cases' discussion.
C) Budgeting and Funding – this section aims at providing PhD students with the main approaches for designing and managing a financial strategy of the firm, thus making them able to economically sustain their business idea. Particular attention will be paid to the role of budget, investments' analysis, business angels, venture capitals, and crowdfunding. Moreover, this section provides PhD students with the basic concepts of risks and risk management as well as methodologies for evaluating investment opportunities in presence of uncertainties, such as Real Options Valuation. This would provide a better understating of the impact that uncertainties and risks characterizing future scenarios, meaning also opportunities, may have on business ideas, in the attempt to make PhD students able to proactively manage uncertainties, thus maximizing profit and reducing financial distress caused by uncertainties. Lessons will be based upon theory and actual cases' discussion.

11. Embedded system design, 2 CFU, SSD: ING-INF/01

Syllabus:
Theoretical part:
Introduction to embedded systems - definitions, general characteristics, fields of application
Overview of platforms and systems on the market
Hardware, firmware and software design flow
Deepening: SoC Nordic nRF52 series Bluetooth Low Energy - architecture and peripherals
Practical laboratory part:
IDE installation

nRF5 Software Development Kit (nRF SDK) choice, installation and usage
Peripheral management (BLE, GPIO, UART, IIC, SPI, PWM)
Examples for low-cost sensor and actuator management

12. Lab-on-chip devices, 2 CFU, SSD: ING-INF/01

Syllabus:
General introduction to Lab-on-chip devices.
Overview of biochemical assays and sequencing techniques.
Introduction to microfluidics.
Materials and fabrication techniques for integrated microsystems.
Electrochemical and photonic techniques for detection
LoC Applications.

13. Research Methodology, 2 CFU, SSD: ING-IND/31

Syllabus:
Research Theory
Ethics and Research
Research Methods and Instruments
Research Project
Case studies and examples where required

14. Antenna technology for 5G communications: propagation, arrays and integration, 2 CFU, SSD: ING-INF/02

Syllabus:
Introduction
Antenna elements and types
Implementation of antenna arrays using basic principles
Characterization and test of antenna and array performance
Radiopropagation, beam steering and beam forming for communication systems

15. Industry 4.0: Optimization, Control and Security, 2 CFU, SSD: ING-INF/04

Syllabus:
The course includes the following four main sections:
1) Industry 4.0 – Introduction and innovations for the industrial companies.
2) Cloud computing system: architecture and design.
3) Optimization and control in a Cloud computing system: centralized and decentralized optimization, multi-agent optimization (distributed task assignment, consensus, etc.), Programmable Logic Controller (PLC).
4) Opacity notion and algorithms to defend crucial information by intruder attacks.

16. Applications of MATLAB, 2 CFU, SSD: ING-INF/04

Syllabus:
Environment of the MATLAB Software
Predefined functions
Working with matrices
Graphical functions
Functions defined by the user
Inputs and outputs controlled by the user
Control structures and logical functions
Symbolic math
Modeling and simulation in Simulink

17. Optimization And Control Of Complex Systems, 2 CFU, SSD: ING-INF/04

Syllabus:

Non-linear optimization. Examples: resource distribution, task planning and scheduling problems.
Introduction to game theory. Connection of games theory with optimization and control.
Introduction to parallel and distributed computation. Parallelization and decomposition in optimization problems. Iterative methods for nonlinear problems.
Decision and control systems architecture: Centralized, Decentralized, Hierarchical and Distributed approach.
Decentralized optimization and control. Primal and dual decomposition. Motivating examples. Resource allocation in single and multi-period.
Hierarchical optimization and control. Multi-level programming. Motivating examples. Optimal planning for complex organizational structures in smart cities.
Distributed optimization and control for large-scale systems. Motivating examples. Scheduling and planning in networked control systems.

18. Reasoning on the Web of Data, 2 CFU, SSD: ING-INF/05

Syllabus:

Modeling and querying the Web of Data: RDF and SPARQL
Reasoning on the Web of data:

- Methods for cutting knowledge-relevant portions of linked data ensuring feasible reasoning solutions
- Definition of reasoning services in RDF

Inferring strategic knowledge from the Web of Data: examples of applications implementing reasoning services in RDF

19. Numerical Methods for Differential Equations, 2 CFU, SSD: MAT/08

Syllabus:

The course includes the following main sections:
1) Initial value problems (IVP) first-order equations; higher-order equations; systems of differential equations
2) Partial differential equations (PDE) the diffusion equation; the advection equation; the wave equation
3) Numerical methods: definition, description (convergence, stability, A-stability...), stiffness, implementation

20. Software tools for modeling optimization problems, 2 CFU, SSD: MAT/09

Syllabus:

Introduction to optimization modeling.
Optimization modeling software tools.
Modeling in Python: tools and case studies.
Advanced modeling techniques.

21. Multi-Criteria Approaches Applied To Multi-Risk Analysis, 2 CFU, SSD: ICAR/09-ICAR/10

Syllabus:

The proposed teaching program aims at preparing PhD students to face interdisciplinary multi-risk analysis by investigating Multi-Hazard, Vulnerability and Exposure through multicriteria decision methods (MCDM).
The program aims at providing an advanced understanding of multi-criteria analysis in order to set up a multi-risk algorithm and optimize mitigation strategies at different scales.

The course consists of:
- an introductory part on Slow Onset Disasters (SOD) and Rapid Onset Disasters (ROD);
- a module which explains the most used multi-criteria methods such as the Analytic Hierarchy Process (AHP), the Analytic Network Process (ANP) and the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS).
- practical exercises developed by each student on a case study regarding their personal research in which algorithms for risk assessment using MCDM are included.

22. Adaptive technologies for the Mitigation of Urban Heat Island and Climate Change Effects, 2 CFU, SSD: ICAR/10.

Syllabus:
The aim of the course is to provide students with the knowledge of the effects of climate change and Urban Heat Island (UHI) on built environment. The course will also provide detailed knowledge on the techniques and technologies to adapt the building fabrics to the effects of climate change and UHI and to counterbalance the temperature increase. The first part of the course will explore in detail the major issues of urban climatology, helping in defining the interaction between environmental variables, outdoor surfaces and building fabrics. In the second part of the course detailed students will investigate in detail adaptive technologies to mitigate the temperature effects of climate change-related phenomena. Examples from successful real case studies will be shown. Finally, the third part of the course will provide students with a hands-on experience of modelling techniques and tools to simulate the thermal characteristics of cities and buildings and assess the impact of adaptation technologies. The assessment will be based on the modelling of a selected case study and on the analysis of the effects of different adaptation technologies.

23. Spatial planning and design matters via applied ontology, 3 CFU, SSD: ICAR/20.

Syllabus:
The course has three main aims: 1) to introduce the student to the applied ontology modeling perspective and its methodologies, 2) to present knowledge tools based on applied ontology, and 3) to acquire practical experience in problem modeling and solving in planning and design. The first aim (applied ontology perspective) is achieved by presenting the state of the art in foundational ontology, the basic distinctions on which it relies, and principles of knowledge organization. The second aim (knowledge tools) is achieved by presenting dedicated software (e.g. Protege) and languages (e.g. OWL) and practicing their use in simple scenarios and in problems of knowledge integration. The third aim (practical experience) is based on hands-on practice session in which the students will model and solve simple planning and design problems. An orthogonal theme that is discussed across all the course parts is the understanding, organization and use of rules (e.g. about engineering planning or design). This theme will be analyzed when introducing the ontology perspective, used to verify the usefulness of knowledge tools and, finally, will provide examples in the practical session.

24. Multivariate Analysis in Environmental Chemistry, 2 CFU, SSD: CHIM/07).

Syllabus:
The course is aimed at providing students with advanced tools for environmental data analysis and innovative elaboration approaches. At the end of the course, students will be able to extrapolate the most relevant information from large datasets, very usual in Environmental Sciences. The lessons will introduce the principal concepts of the Multivariate Analysis and, through a benchmarking with univariate approaches, the benefits of the new techniques will be highlighted. The objective is to develop the ability to choose the optimal model for analyzing data.
The main topics to be discussed are the following:
- Multivariate approach for a multivariate world
- Introduction of Multivariate Analysis. Advantages of Multivariate Analyses.

- Principal Component Analyses (PCA) and Correlation Analyses (CA)
- How to collect the environmental data
- How to pre-treat the environmental data (pretreatment and scaling)
- Methods for “outlier” identification. Means of the “outliers” in Environmental Analyses
- Classification Methods and Prediction Models.

Finally, through discussion of some real applications, the course intends to provide students with few basic rules for a success multivariate analyses in Environmental Chemistry.

25. Statistical methods for environmental analyses in a changing climate, 2 CFU, SSD: ICAR/02.

Syllabus:

Statistical analysis of environmental variables plays a key role in the process of understanding variability and changes in climate-driven phenomena. The usefulness of this approach is widely recognized in literature, and several tools can be implemented for conduct this kind of analysis.

Aim of the course is to illustrate the main concerns about the statistical theory exploited in this field, providing student basic notions for their implementation in R and Matlab programming languages.

The following topics will be covered by proposed course:

1. Introduction to environmental analyses in a changing climate: this introductive part aims to provide a description of key climate variables and their role in interpreting physical phenomena.
2. Notions of probability, statistic and time series analysis: fundamental definitions and axioms of probability and statistic theory; random variables and stochastic processes; statistical characterization of a time series and notes on missing data; references to extreme value theory;
3. Non-stationary processes and statistical test for change-points and trends detection: implications of the presence of deterministic trends in stochastic processes; theory of statistical tests and related errors; power of tests.
4. Elements of R and Matlab and applicative examples: in the last part of the course the utility of Matlab and R programming languages for statistical analysis of real time series will be highlighted. Fundaments of these programs will be illustrated, with the scope to provide main elements for realize a detailed statistical analysis of a time series.

26. Themes and methods of contemporary architectural research, 3 CFU, SSD: ICAR/14.

Syllabus:

The main educational objective of “Themes and methods of contemporary architectural research” course is to provide the PhD student the theoretical basis for the formation of a critical knowledge of the main themes that feed the contemporary architectural research. The course will be articulated into lessons and exercises complementary to each other. Through the lessons the knowledge will be transmitted and the comprehension skills will be developed; through the exercises the acquisition of the ability to apply knowledge and understanding will be verified. The course will be divided into two parts, corresponding to two blocks of lessons and exercises, complementary to each other. The first part of the course will address to general issues concerning the ontology of architecture and its special cognitive status of discipline that lies between the epistemological model of the scientific disciplines and that of the artistic disciplines.

In the second part of the course will be proposed a thematic deepening on three central themes for the contemporary architectural debate, concerning the relationship between "Architecture and City", the relationship between "Architecture and Ancient", the relationship between "Architecture and Construction".

27. The historical research and the study of the Ancient architecture, 3 CFU, SSD: ICAR/18--L-ANT/07.

Syllabus:

Ancient architecture is almost always in a state of ruin. His study, aimed at formulation of reliable hypotheses of reconstruction of the building, must be based on integrated survey methodologies that use the detailed analysis of the ancient ruined building as an essential knowledge base. They are taken into consideration therefore, besides to the observations derived from the results of the architectural survey, also any iconographic testimonies from other sources, such as vascular painting, frescoes, bas-reliefs, images on coins, etc. The building and its construction and morphological details, as well as, when present, his architectural sculpture must then be compared with others contemporary architectures, in order to include it in its historical-geographical context.
The course therefore aims to present some completed or ongoing architectural research that can effectively illustrating the research method mentioned above. In particular, the following case studies will be addressed:
The Arch of Trajan in Leptis Magna
The reconstruction of urban planning of Kos
The Curia in Leptis Magna
Architectural sculpture in the anastylosis of ancient buildings
Urban planning in Ionia and Caria between the archaism and the Hellenistic age
Architectural and decorative models in the mausoleums of the imperial age in Libya
The Hellenistic theater in Mytilene
The townscape in the figurative culture of Greek and Roman times
The urban planning ant the agora of Byllis (Albania)
The Cistern in the agora of Byllis, analysis of the typology and of the constructive aspects.

28. **Historical research and study of the city and contemporary architecture, 3 CFU, SSD: ICAR/18**

Syllabus:
The course is divided into an institutional part of the program and in an experimental part, implemented in the modalities of the Laboratory, within which will be provided some exercises aimed at strengthening the student's critical skills starting from a basic training about the methods and materials for historical research in the second half of the twentieth century.
The course aims to provide students with a correct study methodology aimed at acquiring a historical-critical knowledge of the history of contemporary architecture, from the origins of modern architecture to current architectural trends, with particular attention to the widespread ideas of Italian tendency. and, in particular, to the figure of Aldo Rossi and the masters who revolve around the editors of the Casabella of Rogers, also and above all in relation to the worldwide resonance that they had within the architectural debate after World War II.

29. **Analysis and representation techniques for architectural research, 3 CFU, SSD: ICAR/17.**

Syllabus:
The course aims to stimulate a critical attitude in the study of the city and architecture, providing to the young researcher a repertoire of analysis techniques and representation models to support research.
The techniques of survey of the existing, laser scanner and photo-modeling, are joined to those of the inexistent, graphic analysis and graphic reconstruction, providing the tools and methods for a research of architectures in praesentia that can be studied and analyzed also metrically, that those in absentia designed and never realized.
The course aims to analyze and graphically return the different components of architecture and the city, and with the tools of drawing and modeling investigate the historical / evolutionary process or the ideation / composition process too. These are fundamental cognitive moments for the study of an architecture or a part of the city and at the same time to analyze the complex personality of its author.

Practical exercises alternate with lectures encouraging young researchers to use the techniques of analysis and graphic representation, articulating and stimulating their critical skills in reading an architecture and / or the city or a portion of it.

30. L'architettura delle forme strutturali, 3 CFU 3, SSD: ICAR/12.

Syllabus:

Il corso si articola in una prima parte in cui sono individuate le Forme della Costruzione, ovvero i principi formali che costituiscono il fondamento delle forme strutturali; quindi la conoscenza degli elementi che le costituiscono ed infine le rispettive regole di composizione. I principi formali si riconoscono essenzialmente nel sistema murario, nel sistema trilitico e nel sistema a traliccio, declinati in differenti possibili variazioni che dipendono dall'uso di materiali e tecniche. Allo stesso tempo si riconoscono altri principi riferiti ai sistemi di copertura: la copertura piana, il tetto, la volta, la cupola.

Il corso si avvia con un breve excursus storico, nel quale si mostrano le origini di tali principi, il loro consolidarsi e svilupparsi attraverso il progressivo potenziamento della tecnica. Particolare attenzione si rivolge alle esperienze del Novecento più significative, quando tali principi assumono una rilevanza decisiva nell'assolvere alle necessità della cosiddetta "architettura delle tecniche", cioè al progetto di grattacieli, fabbriche, edifici commerciali, edifici religiosi, ecc.

Non si trascura la costante riflessione che questo tema ha sviluppato, soprattutto nel Novecento, accompagnando la pratica del progetto. Questo aspetto costituirà la parte teorica dell'intero corso.

31. Design and management of research projects, 2 CFU, SSD: ING-IND/17.

Syllabus:

An overlook of main funding opportunities and programmes. The EU financial framework. Basic principles of funding of research projects. The project cycle management methodologies: the logical framework and the WBS, GOPP methodology, stakeholders engagement and management. Tools and techniques for writing good proposals. Techniques and tools for an effective project management. Accounting and financial management of an EU research project. Risk management techniques. The project evaluation, dissemination and replication: good practices and lessons learned.