

### **MIPET Courses, Internship and Master Defense**

In every MIPET module, Professors from University as well as Experts from industry provide direct and interactive opportunities to learn the state of art of Industrial Plant Engineering & Technologies; each single module includes foreground assessments and tests for evaluating the students.

MIPET includes lectures, case studies, examples, testimony, exercises, role play games, simulations as well as tours and visits to real plants and R&D Labs; in addition to these modules a critical component of MIPET is the Internship where the Students are actively involved in a company, working on Industrial Plant Engineering & Technologies and applying the knowledge acquired during this Master; in fact this approach provides an unique opportunity to experience techniques and methodologies on the field.

Each MIPET student needs to develop a full Master Thesis on an Industrial Plant Subjects working on a real project during his Internship and to defend it in front of MIPET Committee; in addition to the Master Thesis students are required to present a Technical Essay during early phase of the internship for additional evaluation of their skills.

### **MIPET BASIC MODULES**

#### **Module 1: Fundamental Concepts related to Industrial Plants Projects (Coordinator: Prof.Bruzzone)**

- Definitions, Characteristics, Key Elements, Disciplines
- Plant Feasibility Analysis
- Tools and Documents for Plant Project Definition, Management and Control

#### **Module 2: Fundamentals of Financial Analysis for Industrial Plants (Coordinator: Prof.Zavanella)**

- Fundamentals in Financial Mathematics applied to Industrial Plant Projects
- Economic and Financial Analysis; Accounting, Economic and Financial KPIs, Overall Plant Project Evaluation,
- Project Financing in Industrial Plants

#### **Module 3: Processes Engineering and Components in Industrial Plants (Coordinator: Prof.Tagliafico & Prof.Tonelli)**

- Fundamentals on P&ID
- Modeling in Industrial Plants: Mathematical Models, Physical Models, Statistical Models; Examples on Complex Processes
- Design and Sizing General Criteria and Component Selection in Industrial Plants
- Design and Sizing General Criteria and Component Selection: Examples
- Plant Processes and Components
- Primary, Secondary and Auxiliary System Analysis and Design

#### **Module 4: Design and Engineering for Industrial Plant Systems (Coordinator: Ing.Pinceti & Ing.Raggio)**

- Fundamentals in Electrical Engineering and High Voltage Power Systems in Industrial Plants
- Power & Energy Market
- Distribution & Power Grid
- Electrical Protection Systems and Short-Circuit Current
- Electrical Earthing Systems
- Main Auxiliary Systems: Water, Air, Liquid Fuel, Steam
- Auxiliary System Engineering & Technologies: Pumping Stations, Control Systems, Safety Systems
- Company Testimony: Auxiliary Systems in Industrial Plants
- Example: Photovoltaic Plant

**Module 5: Material Technology and Mechanical Design for Industrial Plants (Coordinator: Prof.Gambaro)**

- Strain and Stress Fundamentals. Material Selection Criteria Based on Application
- Welding Technologies
- Bonding Technologies
- Static and Dynamic Resistance. Analysis of Fatigue Phenomena (Mechanical and Thermal Fatigue)
- Structural & Mechanical Component Reliability

**Module 6: Automation in Industrial Plants (Coordinator: Prof.Parodi & Ing.Barabino)**

- Fundamentals in Industrial Plant Automation
- Fundamentals of System Control applied to Industrial Plants
- Process Modeling & Control Methodologies & Techniques
- Automation System Architectures
- Evolution in Automation Systems for Industrial Plants
- Example: Automation System in Steel Production Plants
- Example: Automation System Revamping

**Module 7: Software Systems for Supporting Industrial Plant Design & Evaluation (Coordinator: Prof.Bruzzone, Ing.Sadowski)**

- Stress/Strain Analysis on Critical Section of large Industrial Plants
- Computational Models for Industrial Plants
- Industrial Plants: Software Tools for Design, Analysis and Decision Support Systems
- Modeling & Simulation applied to Industrial Plants
- Training Equipment and Simulators
- System Simulation for Iron & Steel Plants
- Exercise: Continuous Casting Process Simulator supporting Design & Analysis
- Tour: Industrial Plant Simulation Labs

## MIPET OPERATIVE MODULES

### **Operative Module 1: Standards & Regulations (Coordinator: Prof.Giribone, Ing.Tremori & Ing.Cerruti)** ***Operative Module open to Master Students and Industrial/Professional Attendees***

- Large Industrial Plants: an Overview on Standards, Regulations and Administration Authorization Processes along Project Life Cycle
- Case Study on Impact of International Regulations on Industrial Plants with Special Attention to Directive 2006/42/CE, ATEX, PED.
- Quality Assurance and Control in Industrial Plants
- Quality, Safety and Environment Integrated Management in term of standards and regulations
- Environmental Impact Evaluation
- Introduction on Fire Safety and Explosion Risk for Industrial Plants. Risk Analysis for Fires and Explosions: methods, documents and classification
- Safety Concept. Innovative Engineering Solutions for Fire and Explosions in Industrial Plants. Combination of Explosion/Fire Risks
- Fire Safety and Explosion Simulation
- Actions: organization, prevention, protection and mitigation solutions
- EXPLOSAD (Experience on Process Plant Safety Design): Case Study based on Simulation applied to fire and explosion protection applied to an industrial plant

### **Operative Module 2: Project Management (Coordinator: Prof.Bruzzone, Ing.Fassone)** ***Operative Module open to Master Students and Industrial/Professional Attendees***

- Project Management and specific issues related to Industrial Plants
- Project Life Cycles
- Reporting & Metrics for Project Management: PMB & KPIs
- Cost and Time Management, Techniques and Methodologies for supporting planning and control
- Risk Analysis & Risk Management: Risk Source Identification, Quantification, Decisional Trees, Statistical Methods and Simulation
- Communications: Technological Solutions, Information Distribution Policies
- HR in Project Management, organizational planning, People Management
- Quality Management: methods, constraints and critical issues in Industrial Plants
- Project Management Networks and Certification Processes
- Coordination Engineering, Purchasing, Erection, Commissioning
- PM Certification, Societies and International Overview
- Role Play Game: Celebes (Cooperative Engineering Plant, Project Business Exercise and Simulation), work to be completed by coordinated teams concurrently working on a complex industrial plant under coordination of real Project Managers and operating on a distributed simulation

### **Operative Module 3: Construction (Coordinator: Prof.Tonelli, Ing.Donetti)** ***Operative Module open to Master Students and Industrial/Professional Attendees***

- Construction of Industrial Plants
- Industrial Plant Construction from Project Start, Precommissioning, Commissioning, Closing
- Case Studies on Project Logistics in National International Frameworks
- Interaction between Engineering and Purchasing
- Case Study on Engineering Purchasing interactions
- Managing Construction Projects on Site
- Case Studies on Construction Yard Management
- Planning and Control on Site Construction
- Case Study on Construction Yard Activities
- Safety on Erections, Heavy Transport and Heavy Lifting during Construction
- Babel Experience: competition between two teams each one divided between Site and Office on a Construction Project; the experience is devoted to outline the critical issues related to coordination/cooperation between engineering and constructions as well as aspects related to communication, human resource management and project documentation

**Safety & Risks (Coordinator: Prof.Taramasso, Ing.Tremori)**

***Operative Module open to Master Students and Industrial/Professional Attendees***

- General Safety concepts related to Industrial Plants Life Cycle (accident pyramid, cause effect analysis, risk analysis, training and information, BBS, main indexes and matrixes, organization)
- Specific safety characteristics on Process Plants
- General Risks on Industrial Plants
- Methodologies and behavioral aspects related to safety and risks to be considered in plant design and construction
- Behavioral aspects influence on accident frequency
- Safety Design
- Quantitative and Qualitative methods to support risk evaluation and management
- Introduction to integrated safety and risk evaluation systems
- Case Study on Safety Integrated Solutions
- Introduction to SBRA Methodology
- Exercise: application of SBRA (Scenario Based Risk Assessment) Methodology on a Construction Yard
- Case Study Resolution on the Construction and Debriefing on SBRA (Scenario Based Risk Assessment) application
- Introduction to Industrial Plant Service impact on Safety along Plant Life Cycle: Availability and indexes, Alternative Approaches, EOH, Impact of Engineering on Service and Safety, Service Inventory, Consistency and Optimization of Inspection and Revision Policies
- Service for Complex Industrial Plants

**MIPET THEMATIC MODULES (Coordinators: Prof.Lucifredi, Ing.Raggio, Ing.Fontana, Ing.Barabino, Ing.Migliorini, Ing.Romairone, Ing.Mozzi, Ing.Traverso)**

**Power Plants (Thematic Module open to Master Students and Industrial/Professional Attendees)  
(Coordinators: Ing.Barabino & Ing. Traverso)**

- Power Plants
- Fossil Plants & Conventional Plants
- Combined Cycle Plants
- Combined Cycle Plant Configuration
- Mechanical Plants
- Environmental Impact of Power Plants
- Electrical Plants
- Piping design
- Power Production Market
- Gas Turbine Plants
- Steam Turbine Plants
- Alternators
- Boilers
- Water Treatment Plants
- Tour: Visit to Power Plant

**Combustion Technology (Thematic Module open to Master Students and Industrial/Professional Attendees)**

**(Coordinators: Ing.Mozzi, Ing. Raggio)**

- **Combustion Technologies**
- Fluid Dynamics & Heat Exchanges in Industrial Plants
- Operational Procedures in Combustion
- Combustion Models for Industrial Plants
- Overview on Heating Furnaces
- Technological Trends in Industrial Furnaces
- Example: Hot Treatment Furnace Design

**Iron & Steel Plants (Thematic Module open to Master Students and Industrial/Professional Attendees)  
(Coordinators: Ing.Fontana, Ing.Raggio, Ing.Mozzi)**

- Iron & Steel Industry Processes
- Iron & Steel Market
- From Raw Material to Blast Furnace
- Fundamentals of Metallurgical Processes
- Metal Making
- Industrial Furnaces
- Blast Furnace
- Iron & Steel Plants: Sinter, Pellet, Steelworks
- Steel Rolling Processes & Heat Treatment
- Strip Processing
- Cold Milling Rolling
- Roll Shops
- Material Handling
- Coke Plants
- Tour: Visit to Steel Plant

**Processes & Machines in Industrial Plants (Thematic Module open to Master Students and Industrial/Professional Attendees)**

**(Coordinators: Prof.Lucifredi, Ing.Romairone)**

- Combustion Technologies
- Fluid Dynamics & Heat Exchanges in Industrial Plants
- Operational Procedures in Combustion
- Combustion Models for Industrial Plants
- Overview on Hot Treatment Furnaces
- Technological Trends in Industrial Furnaces
- Example: Hot Treatment Furnace Design
- Combustion Technologies for Gas Turbine
- Condition Monitoring, Diagnostics, Non destructive Controls and Plant Maintenance
- Vibration Analysis, Modal Analysis, FEM for vibration analysis, TPA, durability, inertial characteristics by experimental analysis, regulations for sustainable vibration analysis, qualification on vibration of mechanical components (sine, random, combined); criteria for requirement definition (mission synthesis), acoustic intensity and holography
- Simulation and Dynamic Analysis of Plants and Machines for Raw Material Handling and Manufacturing
- Industrial Plant Management & Maintenance
- Industrial Plant Services
- Safety & Security in Industrial Plants
- Project Document Flow related to Electrical Systems in Industrial Plants
- Project Document Flow related to Mechanical Drawings in Industrial Plants
- Example: Company Organization within a Power Plant Producer
- Example: Company Organization within a Iron & Steel
- Document Flow for Proposals and Tenders
- Panel Discussion on Documentation & Organization within Industrial Plant Business

**Desalination and Water Treatments (Thematic Module open to Master Students and Industrial/Professional Attendees)**

**(Coordinators: Ing.Fontana, Ing.Migliorini)**

- Waste Water Treatment Plants
- Municipal Solid Waste Treatment: Incineration Plants, Pyrolysis and Gasification
- Case Study: MSW Gasification Plant
- Desalination Plants
- Case Study: Case Study: Desalination Plant - Heat Exchange & Plant Processes
- Case Study: Case Study: Desalination Plant - Material Transfer and Pumping Operations, Alternative Technologies
- Desalination Plants
- Fuel Storage Facilities

**Environment and Sustainability for Industrial Plant Engineering (Thematic Module open to Master Students and Industrial/Professional Attendees)**

**(Coordinators: Prof. Del Borghi, Prof. Tonelli, Ing. Fontana)**

- Environmental Control Techniques within Industrial Plants
- Life Cycle Assessment
- Sustainable engineering: Engineering and the industrial sequence, Green chemistry, Green engineering, The process design challenge, Pollution prevention, The process life cycle, Green technologies
- Design for Environment and Sustainability: Plants and Infrastructure: Electric power infrastructure, Water infrastructure, Transportation infrastructure, Mechanical infrastructure, Infrastructure and building material recycling
- Analysis of technological systems: Industrial ecosystems, Material Flow Analysis, National material accounts, Energy and industrial ecology, Water and industrial ecology, Modeling in industrial ecology
- Industrial ecology and sustainable engineering in developing economies: The three grouping, RDC/SDC dynamic and perspectives, Industrial ecology and sustainable engineering practice in LCDs
- Flue Gas Treatment in Iron & Steel Industry
- Urban Solid Waste Treatments: Incineration Plants, Pyrolysis, Gasification Plants
- Case Study: Gasification Plant

**MIPET OTHER MODULES (Coordinator: Prof. Bruzzone, Dott.ssa Burlando, Ing. Raggio, Ing. Fontana, Ing. Barabino, Ing. Migliorini, Ing. Romairone, Ing. Mozzi)**

**Internship in Sponsor Companies**

- Direct involvement in Real Industrial Plant Projects
- Development of an Essay on Plant Engineering & Technologies during the Internship
- Project Work developed in the Sponsor Company during the Internship
- Master Thesis developed in cooperation with the Sponsor Company during the Internship

**Support Module**

- English Course
- Portuguese/Spanish/Chinese Course (Optional Courses)
- Orientation Panels
- Placement Meetings with Companies