

## **Course Structure**

**Course Code :** SM7308

**Course Title :** Real-Time Hardware Setups

**Credit Hours :** 3

## **Course Description**

Main motivation for simulation, Power System Modelling, Introduction to software Power Factory by Dig Silent, Power flow and load Calculations, Transmission systems in symmetrical and unsymmetrical conditions, unbalanced power flow analysis, Concept of real time simulation, controller and hardware in the loop, PowerFactory.

## **Course Objectives**

- To present the concept of emulating the power grid and hardware in the loop (HIL) for the integration of new components (such as inverters, photovoltaic modules etc.) through commercially available tools such as Matlab Simulink, DigSilent.

## **Course Topics**

- Introduction, course structure and overview textbooks and recommended books, grading. Main motivation for simulation. (Milano Chapter 1)
- Power System Modelling. An overview of the basic principles of physical system modelling (Milano Chapter 2)
- Introduction to software PowerFactory by DigSilent (instructor notes)
- Power flow and load Calculations (Gonzalez-Longatt Chapter 1, Milano Chapter 4)
- Power flow from analytic, algorithmic and software viewpoints.
- Load flow calculations and applications using PowerFactory (Gonzalez-Longatt Chapter 1)
- Description of Transmission systems in symmetrical and unsymmetrical conditions (Gonzalez-Longatt Chapter 2)
- Modelling of Transmission systems under unsymmetrical conditions using PowerFactory (Gonzalez-Longatt Chapter 2)
- Description of the class project, assign teams.
- Introduction to unbalanced power flow analysis (Gonzalez-Longatt Chapter 4)
- Implementation of unbalanced power flow analysis using PowerFactory (Gonzalez-Longatt Chapter 4)
- Concept of real time simulation, controller and hardware in the loop (Gonzalez-Longatt Chapter 15)
- Applications of real time simulation, controller and hardware in the loop using PowerFactory (Gonzalez-Longatt Chapter 15)
- Hardware in Loop Testing (Gonzalez-Longatt Chapter 16)
- Hardware in Loop Testing continued (Gonzalez-Longatt Chapter 16)
- Presentation of Class project
- Review the material for the final exam FINAL EXAM

## **References**

## **M.Sc. in Smart Control Systems for Energy Management**

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### **Course Structure**

- Gonzalez-Longatt, Francisco M., and José L. Rueda, eds. Powerfactory Applications for Power System Analysis. New York, NY: Springer, 2014. Print. Power Systems, ISBN 978-3-319-12957-0
- Milano, Federico. Power System Modelling and Scripting. New York, NY: Springer, 2014. Print. Power Systems, ISBN 978-3-642-13668-9