Siemens Mechatronic Systems
Certification Program

Level 2 SMSCP
Pre-requisite: Successful completion of Level 1 Siemens Examination

1. SMS 201 – Process Control Technologies (~60 hours)
This course covers topics in Closed Loop Control and technologies used in Process Control in the context of a complex mechatronic system. Based on a real system, students will learn the basic functions related to obtaining knowledge of plant documentation and manuals, making suggestions for use in future analysis, creating sets of suggestions for future analysis, and creating diagrams that show the interaction between controllers, sensors and actuators.
The course focuses on helping students to be able to characterise a system by its step response function, and creating and interpreting charts with diagrams for time-based changes of measured values. Students will learn how to establish controller operating parameters and learn the difference between the types of controllers that are typically used in mechatronic systems. PID controllers will be introduced and discussed, along with strategies for optimising them. Based on the step response functions mentioned above, students will learn how to determine which controller is the best one to use. The advantages and disadvantages of ON/OFF and PID controllers are covered in certain systems. Finally, optimisation and troubleshooting of industry controllers are covered.

2. SMS 202 – Intro to Totally Integrated Automation (~60 hours)
This course introduces the Siemens concept Totally Integrated Automation by looking at the automation pyramid. Students will start at the field level with analogue sensors and actuators and later go up to the control level with programming and networking PLCs.
The course begins with connecting different analogue sensors (for example voltage, current, and resistance sensors) to analogue modules. To write a PLC program with analogue values, course participants need to know how to use real numbers. To work with these and other kinds of numbers, the participants also need to get to know additional STEP 7 functions like comparison, memory, arithmetic, conversion, and jump functions.
Later in the course, participants will learn the basics of MPI-Bus and PROFIBUS systems. PLCs will be connected to each other with a bus cable to create an MPI network with the corresponding data configuration in STEP 7. PROFIBUS modules are going to be wired with bus cables to a PLC. Additionally, maintenance and troubleshooting of these bus systems are essential components of the course.
3. **SMS 203 – Automation Systems (~60 hours)**
The Automation Systems course in the Level 2 certification program is divided into two main branches; Manufacturing Technologies, including CNC, CAD and CAM; and Microcontrollers and Programming, which constitute essential tools in modern manufacturing, particularly in mechatronic systems.

When breaking down a system into its constituent modules, it is likely to find a microcontroller as the intelligent core of the entire structure. The microcontroller section begins to explain the theory behind microcontroller and microprocessor architecture, and focuses later on its features and ways of interaction with other electronic elements understanding its particular function, and its role as part of a whole.

4. **SMS 204 – Motor Control (~60 hours)**
This course covers principles of motor control in part as a continuation of the SMSCP Level 1 course on Mechanical Components and Electric Drives. Even though this course builds on the concepts of the related Level 1 course, the Level 1 course is not a prerequisite; equivalent knowledge gained elsewhere will also suffice.

In the first part of the course, General Machine Operation, diverse types of braking and loads on a motor are addressed, as well as questions of improving motor efficiency and power. Different control techniques are then discussed, including different methods of starting a motor, controlling voltage and frequency, and the role of different sensors about motor operation.

Troubleshooting techniques and an examination of the various causes of motor failure are discussed; preventive measures that can be taken to protect motors are also taught.

5. **SMS 205 – Mechanics and Machine Elements (~60 hours)**
This course focuses on the study of the mechanical components that are included in a complex mechatronic system. It begins with an overview of Statics and Kinetics, which includes force system analysis, study of equilibrium, frames and machines, friction and effects of forces on the motion of objects among other basic topics.

The second part of the course focuses on Machine Elements, fundamentals and classification of a variety of components expanding the material into calculations involving force, stress and wear analysis, as well as calculations to determine the distinctive features from a particular component required in given a system. The course focuses on the employment of these techniques for supporting mechatronic systems and to ensure its proper function, correct possible defects that may interrupt the process and to plan preventive maintenance operations on them, observing and incorporating locally enforced and general safety standards. Course 5 of Level 2 provides a
deeper insight into the principles behind the different components of the system. The course aims to form both high and low level mechatronic experts at production and development facilities.

6. **SMS 206 – Manufacturing Processes (~60 hours)**
   This course is divided into two major parts: a section on process management and a section on the function and importance of a hands-on design project. In each case, a blueprint is presented to instructors that they can use when implementing the course at their school.
   For the process management component, a factory simulation is conducted. Each participant is assigned a role and the rules of the simulation are discussed. After a series of runs of the simulation, a discussion and presentation is made, where participants not only present their performance and progress data but also track what they learned.
   For the hands-on design project component, instructors are encouraged and supported in creating a useful design project for students. Students are divided into teams, informed of the rules of the project, given a timeline, budget and a “customer”, as well as other parameters. After completing the project, students present their results and learning outcomes.