# Local Education Plan (LUP)

## MDVP Maintenance Technology program at Techcollege, Vocational component (34 weeks)

## 2025-2026

| **Topic/Module 1:**<br>**Electrical Installations: Foundations in Electrical Systems** | |
|---|---|
| Beginner Level | Duration: 20 Days |

**Proficiency goals**

- The student has knowledge about electrical circuits, voltage, current, and resistance. (18 – GF2)
- The student is able to perform calculations and measurements on serial, parallel, and mixed connections in direct current (DC) (19 – GF2)
- The student is able to use and maintain hand tools correctly when maintaining and constructing electrical installations (6)
- The student is able to use basic wiring techniques and perform installation of simple electrical components (e.g., outlets, switches), based on technical drawings and instructions (2)
- The student has knowledge of safety protocols and regulations in electrical installations (SANS 10142) (7/8)
- The student is able to perform installations in residential buildings with service line, electricity meter, and distribution board, including short circuit -and ground-fault protection devices under guidance. (1)
- The student is able to perform common measurements and troubleshooting on installations under instruction and supervision. (12)
- The student is able to read basic technical drawings, including recognizing commonly used symbols and drawing elements specific to electrical installations. (11)
- The student can perform practical work while adhering to measurements, ensuring it appears visually neat, including being symmetrical and level (8-SB)

**Focus**

This module is focused on providing the students with the first experiences concerning the role and construction of electrical installations and the role of maintenance.

This module is rated as “Beginner Level” based on the Danish Ministry of Education “Taksonomi-vejledning 2021” (Guide to Taxonomy, 2021). Beginner level is defined as the following:

***Beginner level***

*The student can solve a task and perform an activity in a familiar situation or based on a known problem or can carry out a more complex activity with guidance. At this level, emphasis is placed on personal competence to understand the fundamental knowledge and skill areas of the education and competence to develop responsibility and a foundation for continued learning. Independence in task-solving is also established at the beginner level.*[1]

- The student will get to know about electrical circuits, the role of voltage, current and resistance in these circuits and how to calculate missing variables in these circuits. They will also learn to make measurements on circuits, measuring voltage, current and resistance. This will lay the groundwork for future skills in both troubleshooting installations, but also understanding the way current, voltage and resistance interacts.

- The student will become familiar with basic electrical installations, including how to install basic lighting, light switches and outlets. The student will also learn how to determine the amount of wires needed for specific purposes, how to run them (both cable and conduit), and how to install them.

- The student will also be tasked with installing electricity meters and simple distribution boards, including short circuits protection and Ground Fault Devices (RCD). The student is expected to be able to do this under supervision upon conclusion of this module.

- The student is taught how to read and understand basic technical drawings and how to read the most common symbols in drawings of electrical installations. Upon completion of this module students should be able to look at and understand a technical drawing and make a simple installation based on these details.

- The student will become familiar with both safety protocols and regulations concerning electrical installations. By having familiarity with SANS 10142 the student will have knowledge of the standards governing the electrical installation, and should be able to find more information going forward.

- The student will learn how to make sure their practical work is adhering to pre-set measurements, how to achieve symmetry and visually appealing work.

- The students will learn how to perform measurements and troubleshooting on basic electrical installations under supervision. This will take the students from having performed measurements on circuits, to performing troubleshooting under electrical installations. This further lays the groundwork for more advanced troubleshooting later in the course.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, cooperative learning, problem-based learning and experiential learning processes.

[1] Taksonomivejledning, S. 7

**Lecture-based Learning:** Imparting basic knowledge to the students concerning circuits, voltage, current, and resistance.

- Teaching how to perform calculations and how to perform measurements on circuits, and how to compare these values.

- Providing the students with a general overview of the standards and regulations concerning electrical installations (SANS10142)

- Giving students the tools and knowledge to read and understand technical drawing, including the understanding of common symbols and drawing elements.

**Experiential Learning:** Providing the students with the opportunity to practice how to run conduits, how to wire lighting, switches, sockets, electrical boards and electricity meters.

- Practicing how to perform troubleshooting on electrical installations, how to perform measurements and circuits and electrical installations.

- Teaching students how to perform practical work, in line with the standards for electrical installations, how to achieve a visually appealing end product.

- Practicing how to handle and maintain hand tools common to the trade and role of maintenance.

**Cooperative Learning:** In small groups, the students will perform calculations and measurements on circuits.

Similarly, the students will research and learn how to use and read the relevant standards for electrical installations.

- Researching and understanding technical drawings and common symbols.

**Problem-based Learning:** In groups of two, the students will be given a project concerning basic electrical installations.

Together the students will be tasked with building and installing various lights, switches, outlets, running conduits, etc. The students will also be asked to install a simple electrical board.

The students will perform this task based on a technical drawing, which they need to read and understand to accomplish the task. The students will need to perform measurements and troubleshooting on their own installation, upon completion of the installation.

The students are expected to follow the measurements outlined in the project, and be able to deliver a visually appealing end-product, built to the governing standards.

## Topic/Module 2:
## Relay Logic/Motor Control: Basics in automatic processes

| Beginner Level | Duration: 20 Days |
|---|---|

**Proficiency goals**

- The student has knowledge about installations and automation processes in industrial facilities, including service lines, panels, and cable routing systems (15)
- The student is able to perform simple 1-phase and 3-phase motor installations with relay logic, including start-stop, reversing, and emergency stop in industrial facilities (4)
- The student has knowledge of electrical standards governing the safety on machinery (60204-1) (7/8)
- The student is able to read basic technical drawings, including recognizing commonly used symbols and drawing elements specific to relay logic. (11)
- The student is able to apply simple programming, including basic programming structures such as FBD and Ladder in Programmable Logic Controllers (14)
- The student has knowledge about basic forms of sensors and input devices (analog and digital input) (17)
- The student is able to troubleshoot and perform measurements on relay logic systems and PLC based systems under instruction and supervision (12)
- The student can assist in the operation and monitoring of an automated production facility. (2 – Automatik)
- The student can participate in organizing and planning their own tasks (6 – Automatik)
- The student has knowledge on the role of transformers and generators in the electrical grid. (21)
- The student can perform practical work while adhering to measurements, ensuring it appears visually neat, including being symmetrical and level (8-SB)

**Focus**

This module is focused on providing the students with the first experiences concerning the role and construction of electrical installations, automated processes, the functions of relay logic and basic PLC programming and the role of maintenance.

This module is rated as “Beginner Level” based on the Danish Ministry of Education “Taksonomi-vejledning 2021” (Guide to Taxonomy, 2021). Beginner level is defined as the following:

***Beginner level***

*The student can solve a task and perform an activity in a familiar situation or based on a known problem or can carry out a more complex activity with guidance. At this level, emphasis is placed on personal competence to understand the fundamental knowledge and skill areas of the education and competence to develop responsibility and a foundation for continued learning. Independence in task-solving is also established at the beginner level.*[2]

- The student will obtain an introduction to installations and automatic processes in industrial facilities and the role of maintenance in these areas.

- The student will learn how to read basic technical documentation regarding relay logic and PLC installations. These include common symbols, identification of wires and symbols, and the role of documentation in maintenance in automatic processes.

- The student will learn how to build and assemble 1-phase and 3-phase motor installations. Including how to wire start/stop, reversing 3-phase motors, emergency stops and overload protection. The student will also practice how to perform the practical work, so that it adheres to the technical documentation and appears visually neat.

- The student will be taught how to apply basic programming (FBD and Ladder) in Programmable Logic Controllers. Furthermore, they will gain knowledge about common sensors and input devices, both digital and analogue and how to use these.

- The student will gain knowledge concerning the governing standards of machinery (60204-1) and how to apply and recognize this in the automation process

- The student will gain experience with electrical measurements and basic troubleshooting on relay logic and PLC based system. Furthermore, the student will be able to help in the operation and monitoring of an automated process.

- The student will learn and gain knowledge about the role and importance of transformers in the automation process. The student will also learn about the role of generators in the electrical grid.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, cooperative learning, problem-based learning and experiential learning processes.

**Lecture-based Learning:** Providing the student with knowledge on the role of maintenance in the industrial field.

- Teaching the student how to read technical drawing, how to recognize common symbols and how and where to find the standards governing these installations. (Colour of wirings, indicator lights, the colour of buttons, emergency stop, overload protection etc.)

[2] Taksonomivejledning, S. 7

- Teaching the student about transformers and generators, how they function and the role they fulfill in the electrical grid.

**Experiential Learning:** Teaching the students how to wire control panels, including how to follow technical drawings and how to maintain a safe product, that is also visually appealing.

- Providing the students with opportunities to practice how to install a PLC, how to connect basic sensors and how to run and monitor such a system.

- Practicing how to perform troubleshooting and measurements on control panels.

- Teaching students how to perform practical work, in line with the standards for electrical installations, how to achieve a visually appealing end product.

- Practicing how to handle and maintain hand tools common to the trade and role of maintenance.

- Practicing how to perform basic programming in Ladder and FBD on PLC Systems.

**Cooperative Learning:** In small groups, the students will program PLCs in both Ladder and FBD.

Similarly, the students will research and learn how to use and read the relevant standards for machinery and control panels.

- Researching and understanding technical drawings and common symbols.

**Problem-based Learning:** This module is planned to have two group projects for:

Relay-Logic: In groups of two, the students are tasked with drawing and building a 3-phased motor control panel, with elements like emergency stop, overload project, start/stop and the ability for reversing the motor.
The students will have to build a control panel that satisfies the standards (60204-1), which is visually appealing and in working condition. Furthermore, the students will have to manufacture their own technical drawings.
Upon completion, the students will perform electrical measurements and perform troubleshooting as needed. The students will be given a deadline, and are expected to able to organize and manage the tasks as laid out.

PLC: In groups of two, the students are tasked with building a PLC based automated system, involving a conveyer belt, different kinds of common sensors, and a 3-phased motor. The students will be supplied with technical drawings and are tasked with building and installing an installation performing to the standards laid out in the project.
Upon completion the students will perform electrical measurements and perform troubleshooting as needed. The students will be given a deadline and are expected to able to organize and manage the tasks as laid out.

## Topic/Module 3:
## Earthing Systems, Ground Fault Protection and Ingress Protection (IP)

| Beginner | Duration: 5 Days |
|---|---|

**Proficiency goals**

- The student can describe and perform system earthing and protective equipotential bonding in residential and commercial buildings, including TT and TN systems, under guidance. (4-SB)
- The student can perform practical work with respect to Ingress Protection and distance between cables.
- The student has knowledge of - and can describe - the function of Residual Current Devices (RCD)
- The student has knowledge of Ingress Protection and how to make sure specific components adhere to the standards.

**Focus**

This module is focused on providing the students knowledge about earthing systems, short circuits, leakage currents, how to protect against these and the use and role of ingress protection.

This module is rated as "Beginner Level" based on the Danish Ministry of Education "Taksonomi-vejledning 2021" (Guide to Taxonomy, 2021). Beginner level is defined as the following:

***Beginner level***

*The student can solve a task and perform an activity in a familiar situation or based on a known problem or can carry out a more complex activity with guidance. At this level, emphasis is placed on personal competence to understand the fundamental knowledge and skill areas of the education and competence to develop responsibility and a foundation for continued learning. Independence in task-solving is also established at the beginner level.*[3]

- The student will get an introduction and an overview of how TT (Terra-Terra) and TN (Terra-Neutral) earthing systems function and the importance of earthing in electrical installations. The student will also learn about equipotential bonding in residential and commercial buildings
- The student will learn how to install and perform an earthing system (TT and TN) in residential and commercial buildings.
- The student will obtain knowledge about short circuits, leakage current, and how these faults occur.

[3] Taksonomivejledning, S. 7

- The students will obtain knowledge about short circuit protection in electrical boards as well as the function and role of leakage current protection (RCD) and how to install them in electrical boards.

- The student will learn and attain knowledge about Ingress Protection (IP) and how to make sure the right IP-Class is chosen for the task at hand - and what to be aware of when dealing with Ingress Protection.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, cooperative learning, and experiential learning processes.

**Lecture-based Learning:**
Teaching and providing the students with knowledge about the function and usage of earthing systems in an electrical installation.

- Teaching the students how a short circuits and leakage currents happen, and how to protect against these faults in the electrical installation.

- Teaching the students about how RCD functions and how they protect against leakage.

- Teaching the students about the role and usage of Ingress Protection in electrical installations. Providing students with knowledge about how to read and understand the different IP-classes and what to be aware of in the installation.

**Experiential Learning:**

- Showing the students how to install short circuit and leakage protection in electrical boards, and facilitating student practice opportunities for such installation work.

- Showing the students how to install and connect TT and TN earthing systems in electrical installations and facilitating student practice opportunities for such installation work.

**Cooperative learning:**
In groups of two, the students will build and install a complete electrical board, suitable for housing or a small business. The students will have to install the service line, common types of short circuit protection, leakage current protection and both a TT and TN earthing system. The students will also perform different measurements and troubleshooting on the electrical boards.

## Topic/Module 4:
## Data Networks

| Beginner | Duration: 5 Days |
|---|---|

**Proficiency goals**

- The student is able to install network and data cables as well as data connectors (Twisted Pair) and has knowledge about proper installation practices, such as bending radius and clearance distance from power cables (5)
- The student has knowledge about the use of IoT, data collection, and data analysis in electrical installations (16)
- The student has knowledge about fiber cable routing, including bending radius and specific safety measures. (4 – SB)
- The student has knowledge about network cable testing in accordance with applicable standards (5-SB)

**Focus**

This module is focused on providing the students with knowledge about the function and role of networks and data cables, including fiber cables.

This module is rated as "Beginner Level" based on the Danish Ministry of Education "Taksonomi-vejledning 2021" (Guide to Taxonomy, 2021). Beginner level is defined as the following:

***Beginner level***

*The student can solve a task and perform an activity in a familiar situation or based on a known problem or can carry out a more complex activity with guidance. At this level, emphasis is placed on personal competence to understand the fundamental knowledge and skill areas of the education and competence to develop responsibility and a foundation for continued learning. Independence in task-solving is also established at the beginner level.*[4]

- The student will gain understanding and knowledge about network and data cables and the installation practice concerning these, including bending radius and the distance from power lines.
- The student will learn how to install data cables/network cables, including RJ45 and data connectors.
- The student will get a basic understanding of the composition and function of networks.
- The student will gain knowledge about IoT (Internet of things), the role of data collection and data analysis.

[4] Taksonomivejledning, S. 7

- The student will obtain basic knowledge about fiber installations, how they work, how fiber cables work and what to be aware of when handling them

- The student will gain basic knowledge about the role and function of testing network installations and data cables.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, cooperative learning, and experiential learning processes.

**Lecture-based Learning:**

- Teaching students about the workings of networks, how they are set up and how the installation of network cables work (Bending radius and distance to power cables)

- Providing the students with basic knowledge about fiber cables and how they work

- Teaching the students about IoT, how and where to use IoT in housing and industries. How to collect data with IoT and how to do basic data analysis.

**Experiential Learning:**

- Showing the students, and practicing, how to route data cables, how to connect them and install RJ45 and data connectors.

- Instructing the students in how to test network installations and data cables

- Showing how to practice use of IoT devices in various settings and how to set them up and extract data

**Cooperative Learning:**
In small groups, the students will install data connectors and RJ45 on data cables and set up simple home networks.

In groups of two, students will work with simple IoT devices and extract data and perform analysis on this data.

## Topic/Module 5:
## Electrical Installations: Intermediate Level

| Proficient | Duration: 15 days |
|---|---|

**Proficiency goals**

- The student is able to perform installations in residential buildings with service line, electricity meter, and distribution board, including short circuit -and ground-fault protection devices. (1)
- The student can perform common 230/400V installations in residential and commercial buildings, including special areas, in accordance with applicable laws, regulations, and standards. (3 – SB)
- The student can explain the structure of distribution boards and the function of the components, including SPD and RCD (6-SB)
- The student can explain different socket systems, including pin-earth and side-earth (7-SB)
- The student can perform practical work while adhering to measurements, ensuring it appears visually neat, including being symmetrical and level (8-SB)
- The student can troubleshoot and maintain various types of installations, as well as single-phase, two-phase, and three-phase appliances. (17-SB)
- The student is able to prepare technical drawings and recognize commonly used symbols and drawing elements specific to electrical installations. (11)

**Focus**

This module is focused on providing the students with the next step in understanding the role and construction of electrical installations and the role of maintenance. The students are expected to show a greater understanding of electrical installations, as well as working with more advanced installations.

This module is rated as "Proficient Level" based on the Danish Ministry of Education "Taksonomi-vejledning 2021" (Guide to Taxonomy, 2021). Proficient level is defined as the following:

***Proficient Level***

*The student can plan and complete a task or activity or solve a problem in a routine or familiar situation and environment, both independently and in collaboration with others. At this level, emphasis is placed on personal competence in independently understanding more complex issues and communicating with others about their resolution. Additionally, flexibility and adaptability are emphasized.*[5]

[5] Taksonomivejledning s. 8

- The student is able to produce technical drawings, e.g. a complete electrical installation in a house or building, using the correct symbols and drawing elements. The student is able to choose the right type of switches for the customer, know the right amount of sockets and the ideal placements of these and any special rules concerning for example bathrooms or kitchens.

- With confidence, the student is able to make an electrical installations, including connecting a service line, installation of electrical meters, installing a complete electrical board including short circuit protection, RCDs and an earthing system.

- The student is able to install more complex forms of light switches (Multiway switching, latching switch, wireless). The student has knowledge about these and can make informed decision about the use of such switches.

- The student is able to explain and install different forms of sockets, including pin-earth and side earth.

- The student is able to confidently explain electrical boards used in housing and the function of components within (Including SPD and RCD)

- The student is able to troubleshoot and maintain electrical installations and single-phase, two-phase, and three-phase appliances.

- The student can perform practical work on electrical installations to a higher degree of proficiency and is expected to be able to do an installation that is symmetrical, visually appealing and complying with standards and regulations.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, problem-based learning, and experiential learning processes.

**Lecture-based Learning:**

- Teaching the students how to make technical drawings of electrical installations on specialized IT-programs like SEE Electrics

- Providing the students with knowledge about different socket types and how they work.

- Guiding the students in how to select the right type of light switching based on the customer's needs and areas of the house. Similarly with regard to the right amount and placements of sockets.

**Experiential Learning:**

- Showing and practicing with the students how to wire different types of sockets, how to wire and install more complex light switches, including wireless switching.

- Practicing how to troubleshoot problems and faults in electrical installations, and how to locate electricals fault.

**Problem-based Learning:**
In groups of two, students will be tasked with following a set of wishes and demands from a customer, regarding the setup of an electrical installation in a house.

The students will be tasked with preparing technical drawings of the installation and building selected parts of this installation in a workshop environment.

The task and customer wishes will include things like different types of light switches, different kinds of socket types, a complete electrical board including service line and electrical meter, earthing system and 400V installation in the kitchen.

The students will also be tasked with advising the customer how best to maintain and service the electrical installation.

The students will also perform troubleshooting and measurements on the finished product.

## Topic/Module 6:
## Relay Logic/Motor Control: Intermediate

| Intermediate | Duration: 20 Days |
|---|---|

**Proficiency goals**

- The student can assist in building and explaining the construction, commissioning, and troubleshooting of smaller automated systems, where controls based on PLC, relays, and pneumatic components are used. (1 – Automatik)
- The student is able to assist in the operation and monitoring of an automated production facility and make changes to pneumatic controls. (2- Automatik)
- The student can prepare and modify simple documentation (7 – Automatik)
- The student can explain and understand the connection between work on automated machines and systems and applicable laws and regulations, including the relevant safety regulations for the job area. (1 – Automatik)
- The student can select components for and install automated systems and smaller control panels. The student can explain the construction and operation of smaller control panels (1/2/3-SB)
- The student has knowledge about - and can explain - the color codes for actuators, indicator lights, and conductors. (7-SB)
- The student can explain and perform system earthing and protective equipotential bonding in industrial installations, including TT and TN systems. (9-SB)

**Focus**

This module is focused on providing the students with the next knowledge step in the role and construction of electrical installations and the role of maintenance.

The students are expected to show a greater understanding of electrical installations, as well as working with more advanced installations.

This module is rated as “Proficient Level” based on the Danish Ministry of Education “Taksonomi-vejledning 2021” (Guide to Taxonomy, 2021). Proficient level is defined as the following:

***Proficient Level***

*The student can plan and complete a task or activity or solve a problem in a routine or familiar situation and environment, both independently and in collaboration with others. At this level, emphasis is placed on personal competence in independently understanding more complex issues and communicating with others about their resolution. Additionally, flexibility and adaptability are emphasized.*[6]

[6] Taksonomivejledning s. 8

- The student is able to prepare, draw and make changes to simple technical documentation like technical drawings using specialized IT programs.

- Under guidance, the student is able to build and install smaller automated systems, including PLC based ones and ones incorporating pneumatic systems.

- The student is able to troubleshoot smaller automated systems and make changes and install new components.

- The student is able to explain the various components in automated systems (Overload-protection, common types of sensors, PLC's, pneumatic valves)

- The student is able to assist in the monitoring and day-to-day operation of automated systems.

- The student will be able to make small changes to pneumatic systems. (Change of valves or tubes)

- The student understands and can explain the relationship between technical documentation and the set-up in control panels, including being able to pinpoint components on technical documentation and in the control panel.

- The student has knowledge about - and is able to work within - the rules and standards governing control panels and automated system. These will include for example: (Colour of wires, colour of lamps and buttons, rules concerning emergency stops, the necessity of overload protection, the role of transformers in control panels, grounding)

- The student is able to install earthing systems (TT/TN) in industrial installations, including be aware of how to ground motors and metal panels.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, cooperative learning, problem-based learning, and experiential learning processes.

**Lecture-based Learning:**

- Gaining deeper knowledge about the rules and standards concerning automated processes. The student will learn how to find and locate relevant rules.

- Introducing the students to the role of pneumatic systems and how they work.

- The student is taught about the role of monitoring and the day-to-day operation of automated systems.

**Cooperative Learning:**

- In groups of two, the students will experiment with pneumatic systems (See: Experiential learning)

- In groups of 3 or 4, the students will perform maintenance and make changes to already installed control panels. Furthermore, they will make measurements and perform troubleshooting based on these control panels.

**Experiential Learning:**

- The students are tasked with making technical documentation, incorporating both relay logic and PLC, in technical drawing program.

- The students will make a small pneumatic systems, utilizing different kinds of valves (5-2/3-2), how to control speed and how to activate them electronically.

**Problem-based Learning:**
In groups of two, the students are tasked with incorporating various set goals in an automated system of their choosing. These set goals will include a motor, different kinds of sensors, overload protection, emergency stop, PLC, technical documentation, lights, pneumatic system and the ability for the operator to interface with the automated system.

The students have to make their own technical documentation, install and set up the controls board, choose the components needed, wire the set-up, program the PLC and install a small pneumatic system. Furthermore the students are expected to be able to do troubleshooting on the system afterwards.

The system shall be compliant with the standard 60204-1 and be visually appealing.

During this assignment the students will gain a greater understanding of the role of documentation, the rules concerning automated systems, gain deeper knowledge about common components used in control panels, how to perform earthing, be able to see the interplay between documentation and the finished product.

Furthermore, the students will prepare a small assignment consisting of technical documentation, list of components used and a user manual.

## Topic/Module 7:
## Building Automation – Basic HVAC Systems

| Beginner | Duration: 6 days |
|---|---|

**Proficiency goals**

- The student has knowledge about the installation and programming of simple ventilation systems with multiple fans in industry. (H1)

- The student is able to install and program smaller ventilation systems. (H1)

**Focus**

This module is focused on providing the students with basic experience in the role and function of HVAC Systems.

This module is rated as "Beginner Level" based on the Danish Ministry of Education "Taksonomi-vejledning 2021" (Guide to Taxonomy, 2021). Beginner level is defined as the following:

***Beginner level***

*The student can solve a task and perform an activity in a familiar situation or based on a known problem or can carry out a more complex activity with guidance. At this level, emphasis is placed on personal competence to understand the fundamental knowledge and skill areas of the education and competence to develop responsibility and a foundation for continued learning. Independence in task-solving is also established at the beginner level.*[7]

- The student has knowledge about the basic structure of ventilation systems and how they function. The student will learn the importance of ventilation in industrial systems, and how the role of maintenance plays into the function of these systems. Furthermore, the students will gain knowledge about basic climate systems and the role they play in housing and industry.

- The student has knowledge about how to install ventilation and the programming of simple ventilation systems in industry.

- The student is able to install and program small ventilation systems, ranging from basic bathroom ventilation to small industrial ventilation systems.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning and cooperative/experiential learning processes.

**Lecture-based Learning:**

- The student will learn about the role and importance of ventilation, in housing as well as industry.

[7] Taksonomivejledning, S. 7

- Teaching the students about the function and basic structure of ventilation systems.
- Lecturing the students on the role of climate systems and how they function.
- Providing students with knowledge about the programming of ventilation systems and the differences between different types of ventilation (CAV/VAV)
- Teaching the students about the need for ventilation, as well as rules regarding the ventilation of both commercial areas and industry.

**Cooperative/Experiential Learning:**
In groups of two, the students will perform installation of simple ventilation systems (Small bathroom ventilation and basic industrial ventilation)

- Following this, students will perform basic programming of the same ventilation systems.
- The students will perform simple calculations to estimate the needed change of air in certain environments (offices, industry, commercial)

## Topic/Module 8:
## Customer Service – Internal/External

| Intermediate | Duration: 5 days |
|---|---|

**Proficiency goals**

- The student has knowledge about customer service - both internally within the company and externally with customers. (23)

- The student has knowledge about methods for effective communication, including questioning techniques, personal appearance, and professional behavior (1-SB)

- The student can search for and evaluate technical information relevant to the work area and communicate the results to colleagues using correct professional terminology. (8-SB)

**Focus**

This module is focused on providing the students with skills in communication and customer service. The module teaches the importance of personal appearance, the role of professional behavior, how to handle customer requests and how to communicate internally in the workplace.

This module is rated as "Proficient Level" based on the Danish Ministry of Education "Taksonomi-vejledning 2021" (Guide to Taxonomy, 2021). Proficient level is defined as the following:

***Proficient Level***

*The student can plan and complete a task or activity or solve a problem in a routine or familiar situation and environment, both independently and in collaboration with others. At this level, emphasis is placed on personal competence in independently understanding more complex issues and communicating with others about their resolution. Additionally, flexibility and adaptability are emphasized.*[8]

- The student will gain valuable knowledge about the role of customer service, both internally and externally. The knowledge gained here will prepare the students to be service-minded and be able to work together with both coworkers and customers alike. This will teach the students the importance of clear communication, listening to wishes from coworkers and customers, and how to handle these.

- The student will attain knowledge about personal appearance and why it matters in the workplace, both to the customer, but also why it is important in working with coworkers. This will also lead to the student learning about professional behavior in the workplace and when dealing with customers, teaching the students how to behave and conduct themselves to a high degree of professionalism.

- The student will learn about effective methods of questioning, giving the students are better chance to inquire about demands set from customers, as well as more effectively attain knowledge internally in the workplace from more experienced coworkers.

[8] Taksonomivejledning s. 8

- The students will learn how to search for new technical information in the work areas, and they will learn how to evaluate the information and be critical about it. Furthermore, the students will learn how to clearly communicate these findings to coworkers, using the correct terminology.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning and cooperative/experiential learning processes.

**Lecture-based Learning:**

- Teaching the students about the role of communication, how to use it effectively and the role it plays inside the workplace with colleagues, as well as with customers.

- Stressing the importance of personal appearance and how this plays together with professional behavior and why it is important in gaining and keeping employment.

- Teaching the students how to best inquire and be curious in the workplace, thereby gaining new and important knowledge. Moreover, the students will learn how to inquire about customer requests.

- Teaching the students how to ascertain new knowledge and how to able to evaluate the correctness and value of said knowledge. Furthermore, the students will learn how to share new knowledge with coworkers, using correct terminology.

**Cooperative/Experiential learning:**
Groups of 3-4 students will be assigned different kinds of cases based on workplace behavior and appearance. The students will discuss these cases and their perspective on them in the groups. At the end of the session a broader discussion will take place involving the entire class concerning these topics, with the instructor offering feedback on the student perspectives.

- Groups of 3-4 students will be presented with a fictional, intentionally vague, building assignment from a customer (Most likely a house installation). The roles of the students are to discuss the assignment, and which questions to ask the customer to clarify the wishes of the customer. The instructor will play the role of the customer.

- In groups of two the students will be assigned a topic of interest they have to research and gather information on. Taking notes and preparing how to pass this knowledge on to the other students, the students are later mixed into later groups of 5 students, and have to share this newfound knowledge to the other students. The other students are expected to question this knowledge, to further their own understanding of the new subject. Teaching the student both how to share new knowledge, but also how to question it and attain it from coworkers.

## Topic/Module 9:
## Building Automation – Lighting

| Intermediate | Duration: 7 days |
|---|---|

**Proficiency goals**

- The student has knowledge about the use of IoT, data collection, and data analysis in electrical installations.
- The student can install and program simple intelligent energy monitoring, such as energy measurement in panels, machines, and electrical equipment, in accordance with the manufacturer's instructions. (19-SB)
- The student can install and program various simple intelligent lighting systems, in accordance with the manufacturer's instructions. (20-SB)
- The student can perform troubleshooting, servicing, and maintenance on basic intelligent lighting installations. (1.3).

**Focus**

This module is focused on providing the students with knowledge re. intelligent lighting systems, IoT devices, how to install simple intelligent lighting systems and how to troubleshoot intelligent lighting systems.

This module is rated as "Proficient Level" based on the Danish Ministry of Education "Taksonomi-vejledning 2021" (Guide to Taxonomy, 2021). Proficient level is defined as the following:

***Proficient Level***

*The student can plan and complete a task or activity or solve a problem in a routine or familiar situation and environment, both independently and in collaboration with others. At this level, emphasis is placed on personal competence in independently understanding more complex issues and communicating with others about their resolution. Additionally, flexibility and adaptability are emphasized.*[9]

- The students will obtain expanded knowledge on the role and use of IoT in electrical installations. They will gain further knowledge by learning to install and program basic energy monitoring systems in for example electrical panels or electrical equipment. They will furthermore collect this data and do analysis on it.
- The students will learn how to install and wire basic intelligent lighting systems (Example: Phillips Hue integration with a Phillips Hue Bridge)
- The students will also learn how to install and program various sensors, including detection sensors and LUX sensors.
- The student will learn how to perform maintenance and troubleshooting on basic intelligent lighting systems.

[9] Taksonomivejledning s. 8

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning and cooperative/experiential learning processes.

**Lecture-based Learning:**

- Teaching the students about the use of IoT and the usage of intelligent lighting in housing and commercial areas.

- Teaching the students the importance of data collection and the analysis of said data. Especially concerning the usage of energy.

- Teaching students about basic intelligent lighting systems, different types, how they work, how to wire them and the usage of motion detection and LUX sensors.

**Cooperative/Experiential Learning:**
In groups of 2-3, the students will assemble a small electrical installation, based on intelligent lighting, with a few switches and lights, the ability to control the lights from a computer or smartphone, and the ability of the light to control itself based on factors such as time of day, lighting level or motion detection.

Furthermore, the students experience wiring smart sockets and basic IoT data collection components.

- The students will collect data from energy measurements from the smart devices and do a analysis on the obtained data. Comparing for instance the energy saving of motion detection to a light being turned on based on time of day as an example.

- The students will wire these installations on their own, making sure to research the manufacturer's instructions and performing the installation in accordance with these.

- The students will perform measurements and troubleshooting on the installations upon the completion on the installation. Making sure that the installation is wired correctly and fixing any mistakes encountered.

## Topic/Module 10:
## Electrical Grid – Present and the future

| Proficient | Duration: 13 days |
|---|---|

**Proficiency goal**

- The student has knowledge about the structure of the electrical supply network, including production, transmission, distribution, and storage of electrical energy including renewable energy sources, as well as the climatic and operational consequences thereof. (13)
- The student can connect charging stations to public or private power supply. (4-SB)
- The student has knowledge about the construction of distribution transformers and is familiar with different types of transformers. (8)
- The student has knowledge about sustainable electricity production, power-to-X (PtX), and the future balanced power grid (12)
- The student has basic knowledge about electrical safety and working on high-voltage systems, such as job roles, clearance distances, and lockout/tagout procedures. (13-SB)
- The student has completed a hands-on project experience re. installation of a renewable energy system (e.g., small wind turbine or solar PV system).
- The student has knowledge about energy storage solutions (e.g., batteries, thermal storage) and the integration of renewable energy with existing building systems

**Focus**

This module is focused on providing the students with knowledge about the electrical supply networks, how transmission, distribution, transformation and storage of electrical energy functions. Furthermore, the student will gain practical experience in the installation of charging station for EVs and the installation of renewable energy systems (Example small wind turbine or solar system). The students will also gain basic knowledge about safety on high-voltage systems, including job roles and lockout/tagout (LOTO).

This module is rated as "Proficient Level" based on the Danish Ministry of Education "Taksonomi-vejledning 2021" (Guide to Taxonomy, 2021). Proficient level is defined as the following:

***Proficient Level***

*The student can plan and complete a task or activity or solve a problem in a routine or familiar situation and environment, both independently and in collaboration with others. At this level, emphasis is placed on personal competence in independently understanding more complex issues and communicating with others about their resolution. Additionally, flexibility and adaptability are emphasized.*[10]

[10] Taksonomivejledning s. 8

- The student will obtain knowledge about the structure and workings of electrical production, distribution, and the role transformers play in the distribution and the storage of energy.

- The student will obtain knowledge about sustainable and renewable forms of energy production and different kinds of storage solutions for electrical energy and how to integrate renewable energy sources into existing buildings.

- The students will learn how to install charging stations for EVs in both private housing and in public.

- The students will learn how to install basic small wind turbines or basic solar energy systems.

- The students will gain important basic knowledge about working safely on high-voltage installations, including the importance of clearing distances, job roles and Lockout/Tagout.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, cooperative learning, and experiential learning processes.

**Lecture-based Learning:**

- Gaining knowledge about the electrical grid, including transmission and distribution and the role of transformers.

- Learning about working on high-voltage systems and the role of role of personal safety

- Introduction to sustainable energy production and the consequences of this.

**Cooperative Learning:**

- The students will write a report based upon findings regarding the electrical grid, including elements of power-to-X, smart grid, sustainable energy production and the consequences of these. This report will be done in groups of 2-3 students. Giving them the role of researchers within these subjects.

**Experiential learning:**

- The students are tasked with installation of a charging station to both private and public supply.

- The students will have practical experience in installing either a small solar power unit or a small wind turbine and connecting it to an electrical installation.

## Topic/Module 11:
## Personal Safety

| Certification | Duration: 6 Days |
|---|---|

**Proficiency goals**

- To ensure that students are fully prepared for health emergencies, the risk of fires, working on or near live electrical installations and working on or setting up rolling and folding scaffolding, the training program also includes the following Certifications, which will be obtained by the students as part of the module:

- Instruction in working near or on live installations, in accordance with the executive order on safety for the execution and operation of electrical installations.

- Competencies equivalent to "First Aid in Vocational Education" according to the Danish First Aid Council's training plans as of October 2020.

- Competencies equivalent to basic firefighting according to the guidelines of the Danish Fire and Security Institute as of September 1, 2014.

- Certificate for meeting the Danish Working Environment Authority's educational requirements for the setup and use of rolling and folding scaffolds

**Focus**

This module will focus on providing students with the standard training processes for obtaining the above certifications, as specified by the respective authorities or regulations underwriting the issue of certifications.

The training (instruction/tuition and Student practice documentation of sufficient knowledge and skills for obtaining certification) is not rated under the Danish Ministry of Education “Taksonomi-vejledning 2021” (Guide to Taxonomy, 2021).

## Topic/Module 12:
## Water and drainage

| Beginner/Routine | Duration: 4 weeks |
|---|---|

**Proficiency goals**

- The student is able to produce and use working drawings (manual and electronic), sketches and diagrams, including the use of industry-relevant symbols.
- The student has knowledge about relevant laws, regulations, standards and quality assurance systems for carrying out water and drainage installations.
- The student can select and account for materials for simple water and drainage installations in buildings.
- The student is able to carry out simple measurements and calculations and prepare material and parts lists using material designations, number, quantity and length.
- The student can apply measurement methods and measuring tools in connection with marking, assembly, levelling and placement of water and drainage installations using, a/o levellers.
- The student can perform installation and preparation for operation of individual water and drainage systems.
- The student is able to perform the tasks safely and environmentally responsibly, in accordance with applicable regulations.
- The student can independently perform plastic welding on pipe systems that meet applicable standards and quality targets, as well as explain relevant safety and environmental conditions and requirements when performing plastic welding.

**Focus**

The module is focused on providing the students with the knowledge and skills to carry out a minor water and drainage installation in the workshop with knowledge of good craftsmanship, cleaning and finishing when submitting such work.

This module is rated as "Beginner Level" based on the Danish Ministry of Education "Taksonomi-vejledning 2021" (Guide to Taxonomy, 2021). Beginner level is defined as the following:

***Beginner level***

*The student can solve a task and perform an activity in a familiar situation or based on a known problem or can carry out a more complex activity with guidance. At this level, emphasis is placed on personal competence to understand the fundamental knowledge and skill areas of the education and competence to develop responsibility and a foundation for continued learning. Independence in task-solving is also established at the beginner level.*[11]

[11] Taksonomivejledning, S. 7

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, cooperative learning, and experiential learning processes.

The teaching is organized as an interaction between practical theory and practical tasks, and all topics are placed in relation to the current vocational education. The theoretical material is used in a practical and realistic context as much as possible.

**Lecture-based Learning:**

- The students will be provided with knowledge about water supply, transmission and distribution systems and the construction of water supply security in terms of safety and pollution.
- The students will also gain knowledge about drainage installations in terms of construction, protection against bacteria, odor and rats.
- The students will learn about working safely.
- Introduction will be provided to sustainable installation production and the consequences thereof.

**Experiential learning:**

- The students are assigned tasks to design and install a water and drainage installation.
- The students will gain practical experience in designing and installing a water and drainage installation.
- Students will gain practical experience with assembly methods within water and drainage installations.
- Students will gain practical experience with delivering and quality-assuring water and drainage installations.

**Cooperative Learning:**

- The students will write a report based on the practical assignment and on the results regarding water supply and drainage installations. The topics concerned must be touched upon. This report will be made in groups of 2-3 students.
- The report writing will introduce students to the role of being researchers within these topics.

## Topic/Module 13: Ventilation

| Beginner/Routine | Duration: 7 days |
|---|---|

**Proficiency goals**

- The student has knowledge about basic drawing techniques and projection drawings, including the use of industry-relevant symbols.
- The student can produce and use manuals, working drawings, sketches, diagrams and unfolding of practical tasks based on knowledge of practically related and basic drawing techniques and projection drawings.
- The student is aware of – and knows – the applicable laws, regulations and standards within electrical engineering work.
- The student can use and make simple measurements for current, voltage and resistance.
- The student is able to use basic electrical concepts for voltage, current, resistance and power for electrical engineering calculations.
- The student has knowledge about the structure and function of simple air conditioning and ventilation systems.
- The student is aware of – and knows – the relevant laws, regulations, standards and quality assurance systems for performing installation work.
- The student can carry out simple measurements of air flows in air conditioning and ventilation systems and adjust these according to the proportional method.
- The student can use measurement methods and measuring tools in connection with marking and installing ventilation ducts.

  The student can explain simple IT-based monitoring and control automation in air conditioning and energy installations.

**Focus**

The module is focused on providing the students with the knowledge and skills to build a simple ventilation system, where measurements and adjustment can subsequently be made according to the proportional method.

This module is rated as “Beginner Level” based on the Danish Ministry of Education “Taksonomi-vejledning 2021” (Guide to Taxonomy, 2021). Beginner level is defined as the following:

***Beginner level***

*The student can solve a task and perform an activity in a familiar situation or based on a known problem or can carry out a more complex activity with guidance. At this level, emphasis is placed on personal competence to understand the fundamental knowledge and skill areas of the education and competence to develop responsibility and a foundation for continued learning. Independence in task-solving is also established at the beginner level.*[12]

- The student is able to draw, unfold and form a simple ventilation duct, including transition from square to round.

- The apprentice/student must have basic electrical knowledge that enables the student to make simple measurements and calculations.

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, cooperative learning, and experiential learning processes.

The teaching is organized as an interaction between practical theory and practical tasks, and all topics are placed in relation to the current vocational education. The theoretical material is used in a practical and realistic context as much as possible.

**Lecture-based Learning:**

- The students will be taught about the structure and functioning of ventilation systems, regarding safety and the spread of bacteria.

- Students will be provided with knowledge about calculating air volumes and adjusting ventilation and extraction systems.

- Students will be taught about working safely with equipment and measuring instruments.

- Students will be Introduced to sustainable installation production and the consequences thereof.

**Experiential learning:**

- The students are assigned to design and install an extraction system, calculate air volumes and carry out adjustment.

- The students will gain practical experience in designing, installing and adjusting an extraction and ventilation system.

- The students will gain practical experience in delivering and quality-assuring ventilation systems.

[12] Taksonomivejledning, S. 7

**Cooperative learning:**

- The students will write a report based on the practical assignment and on results regarding ventilation systems. The topics concerned must be touched upon. This report will be made in groups of 2-3 students.

- The report writing will introduce students to the role of being researchers within these topics.

## Topic/Module 14:
## Heat Pumps – Installation and service

| Beginner/Routine | Duration: 8 days |
|---|---|

**Proficiency goals**

- The student can install, function test and adjust heat pumps.
- The student has knowledge about different types of heat pumps, their basic physics and operating principles, including the characteristics of the heat pump cycle and the function of components therein.
- The student has knowledge about the operation of heat pumps as a heat source and as a cooling source, as well as energy and environmental labeling for heat pumps.
- The student is able to work based on current relevant legislation, including building legislation, authorization legislation, noise legislation and the geothermal executive order.
- The student can perform service on heat pumps.

The module is focused on providing the students with the knowledge and skills to functionally understand, install and service heat pumps of various types.

This module is rated as "Beginner Level" based on the Danish Ministry of Education "Taksonomi-vejledning 2021" (Guide to Taxonomy, 2021). Beginner level is defined as the following:

***Beginner level***

*The student can solve a task and perform an activity in a familiar situation or based on a known problem or can carry out a more complex activity with guidance. At this level, emphasis is placed on personal competence to understand the fundamental knowledge and skill areas of the education and competence to develop responsibility and a foundation for continued learning. Independence in task-solving is also established at the beginner level.*[13]

**Delivery**

This module is delivered through the application of a mixture of lecture-based learning, cooperative learning, and experiential learning processes.

The teaching is organized as an interaction between practical theory and practical tasks, and all topics are placed in relation to the current vocational education. The theoretical material is used in a practical and realistic context as much as possible.

**Lecture-based Learning:**

- The students will gain knowledge about construction - understanding and practical knowledge of basic things such as construction and servicing of heat pumps and small refrigeration systems.

[13] Taksonomivejledning, S. 7

- The students will be taught about the safety and environmental aspects with special focus on the greenhouse effect associated with working on systems containing F-gas refrigerants, as well as relevant legislation in the area.

- The students will learn to work safely with equipment and measuring instruments

- The students will be Introduced to sustainable installation production and the consequences thereof.

**Experiential Learning:**

- The students will practice how to perform correct leak tests.

- Students will practice brazing of pipe installations for cooling and heat pumps.

- Students will gain practical experience in designing, installing and adjusting a cooling and heat pump system.

- Students will gain practical experience in delivering and quality-assuring cooling and heat pumps.

**Cooperative Learning:**

- Students will write a report based on the practical assignment and on results regarding heat pumps and small refrigeration systems. The relevant topics must be covered. This report will be done in groups of 2-3 students.

- The report writing will introduce students to the role of being researchers within these topics.

**Topic/Module 15:**
**Capstone Projekt**

| | Duration: 14 days |
|---|---|

**Project Details**

This is the end project for the entire vocational program. As such there are no proficiency goals, instead the students have to apply/use some of the experience and knowledge they have gained throughout the entire course, to build an installation containing key elements from the other modules.

This means that the project will incorporate some form of light installation, some type of motor control and some plumbing or ventilation.

The students will be graded on the workmanship displayed and their knowledge of the installation.

This exam will take the form of an oral exam, conducted individually, although the project is completed in groups of 2-3.

**Scope of the project:** The students will be tasked with building and documenting an installation. The requirements to the installation are that it must contain:

- Some form of electrical light installation, including a electrical board, sockets, light, different light switches.
- A motor control installation. This motor control installation must live up to certain requirements, like type of motor, number of sensors, and how to control it.
- Either a ventilation installation, a heat pump installation, or a water and drainage system.

The students must produce technical documentation for all the parts of the project, including drawings and a maintenance plan for installation.

**Grading:**

The students will be graded upon their knowledge of the installation, and the parts incorporated. The documentation quality will also be included in the grading basis.

An oral exam will be conducted to allow the students to show their knowledge and their experiences gained. The exam will be conducted with a single student at a time, with a timeframe of 30 minutes per student.

The grade will be Pass/Fail. Upon completion, the student will have passed the entire vocational program in Maintenance Technology and will receive his/her non-formal Program Completion Diploma issued by Techcollege.