ECVET – Curriculum

UNIT TEMPLATE

Institution:	IEK DELTA
Programme/Training Title:	Domestic Electrical Installations Technician
Unit Title:	Electrotechnology and Applications
Unit Type (e.g. major, minor, elective):	Core
Unit Level:	EQF Level 5
Duration:	135 guided Hours
Pre-requisites:	EQF Level 4
Instructor:	George Miglis
Number of ECVET credits:	14

Learning Outcomes

By completion of this unit the learner should be able to

1. **Apply** the basic laws of electricity.
2. **Resolve** simple circuit AC and DC devices (single – three-phase).
3. **Describe** the basic methods for measuring the voltage, current, resistance and power in low power circuits.
4. **Read** wiring diagrams of traffic facilities and windings of AC and DC machines.
5. **Measure** electrical quantities.
6. **Use** electrical tools (screwdrivers, cutter, pliers, stripper pipeline, terminal clamp, insulating tape, soldering, etc.).

Domestic Electrical Installations Technician
Electrotechnology and Applications

Learning outcomes By the end of this course a learner is expected to:	Method of Assessment	ECVET System		Estimated student work time in hours
1. **Apply** the basic laws of electricity.	• Multiple choice test • Monthly assignment • Final exam • Class discussion • Class participation	K	• Identifies and describes the basic principles of electricity engineering (power, voltage, electromagnetism) • Describes the Ohm's law • Describes the Joule's law • Describes the Ampere's circuital law • Describes the Lenz's law	19
		S	• Applies the Ohm's law • Applies the Joule's law • Applies the circuital law • Applies the Lenz's law	
		C	-	
2. **Resolve** simple circuit AC and DC devices (single – three phase).	• Multiple choice test • Monthly assignment • Final exam • Class discussion	K	• Knows the basic principles of AC – alternating current systems • Knows the basic principles of three phase current • Knows the methods of measurement	19

	• Class participation	S	• Changes – adjusts the scale • Calculates the instrument error • Compares the voltages	
		C	• Calculates the energy and power in DC and AC circuits	
3. **Describe** the basic methods for measuring the voltage, current, resistance and power in low power circuits	• Multiple choice test • Monthly assignment • Final exam • Class discussion • Class participation	K	• Chooses the appropriate methods for the measurement of voltage, current, resistance and power in low power circuits • Identifies the class of instruments – precision • Identifies the errors and classification of instruments • Identifies the types of instruments used	23
		S	• Identifies the causes of measurement errors • Chooses the appropriate instruments	
		C	-	
4. **Read** wiring diagrams of traffic facilities and windings of AC and DC machines	• Multiple choice test • Monthly assignment • Final exam • Class discussion • Class participation	K	• Knows the symbolism – categories of instruments	26
		S	• Explains the elements of AC and DC electrical installation	
		C	-	
5. **Measure** electrical quantities.	• Multiple choice test • Monthly assignment • Final exam • Class discussion	K	• Knows the methods of measurement	18
		S	• Uses appropriate measuring instruments • Organizes measurements (maintenance, inspection, repair and calibration of	

	• Class participation		measuring instruments)	
		C	• Performs autonomously current intensity measurements • Performs autonomously resistance measurements • Performs autonomously AC measurements	
6. **Use** electrical tools (screwdrivers, cutter, pliers, stripper pipeline, terminal clamp, insulating tape, soldering, etc.).	• Laboratory attendance • Laboratory exercise	K	-	30
		S	-	
		C	• Assembles, connects, controls reading instruments • Measures instant and active voltage value with oscillograph • Assembles, connects, controls lights • Connects limits marking instruments • Performs single electrical supply system and power supply of lighting objects • Connects panels of three (3) to five (5) lines • Connects, counts, checks the ground • Performs three – phase electric motor supply system • Performs simple electric drainage facility to DC and AC generators network • Connects and checks electric DC motor circuits • Connects and checks AC motor circuits	

			• Connects, counts, checks the insulation in DC and AC motor	
				TOTAL **135**

Unit Contents

A Semester

1. Electricity (intensity, density, power, units)
2. Voltage, Electromotive power source, DC and AC power sources, electric resistance. Ohm's law, resistance, temperature – dependence, Voltage fall to conductors. Energy and power in DC. Joule's law
3. Electromagnetism, Straight pipe – coil magnetic field, Magnetic induction and flow, circuital law, paramagnetic and ferromagnetic materials. Magnetization – demagnetization of materials, lag loop, electromagnetic induction, Lenz's law, Inductance, Inductance coefficient. Mutual inductance. Mutual inductance coefficient
4. Measurements in DC, Errors and instruments classifications. Instruments class – accuracy. Error causes. Symbolisms – Instruments categories according to the measured size and their operating principle. Moving coil instruments. Moving iron instruments. Digital instruments
   Intensity measurement, measurement methods, types of instruments used, selection of the suitable instrument. Change – scale adaptation, implementation, and instrument error calculation.
   Resistance measurement, resistance measurement methods with voltmeter and ammeter, compare trends, ohmmeter, Wheatstone bridge, string bridge, Murray bridge, resistance boxes, regulators resistance, and measurement of insulation resistance with Megger.
5. Alternating current, AC output, frequency and effective value of AC and voltage. Vector representation of AC values. Phase difference. Inductive and capacitive resistance, inductors and capacitors (properties, types, applications), characteristics of capacitive and inductive consumers. Energy and power in AC. Real, reactive and apparent power. AC Circuits. Equivalent electric circuits, consumer connection methods. Electric power consumer rate. Power factor correction. Measurements in AC. Operating principle and type of Wattmeter,

frequency meters and cosine meter. Ammeters – Voltage transformers.

6. Three – phase current. Three – phase voltage. Three- phase voltage output. AC consumer connections in star and triangle. Three – phase power (active, reactive and apparent power)

B Semester

1. Reading and recording instruments. Reading instruments (analog – digital): Components, Nominal values, class. Recording instruments (galvanometers, compensation instruments) continuous and batch recording
2. Error measurement based on the measurement method and the instrument class.
3. Limited values marking instruments. Operating principle. Typical static and dynamic lag
4. Oscillograph. Operation principle. Structure. Use
5. Issues about measurement. Maintenance, inspection, repair and calibration of measuring instruments.
6. Elements of AC and DC electrical installations. Switchboard. Switchgear and control instruments. Simple supply circuits. Grounding.
7. Key elements of electrical machines. Operation principle of AC and DC generators and motors. Key operating characteristics. Applications
8. Main transformer components: transformers operating principle. Components: transfer relationship. Transformers operation in vacuum and under load. Short circuit current. Transformers features (sizes, load limits, tolerance) Applications

Laboratory Exercises

A Semester

1. Recognition and use of ammeters, voltmeters, multimeters.
2. Change and extension of ladders.
3. Voltage measurement with voltmeter and multimeter.
4. Intensity measurement with ammeter and multimeter.
5. Resistance measurement with voltmeter, ammeter, voltage comparison, Wheatstone bridge, String Bridge.
6. Measurements in parallel, series circuits and mixed – resistance connection

7. Insulation Resistance measurement with Megger
8. Power measurement in DC with voltmeter, ammeter and wattmeter
9. Measurement of electrical quantities of simple devices
10. Measurement of capacitors, coils, capacitive and inductive resistance
11. Measurement in complex circuits resistors, capacitors and coils
12. Use and assembly of wattmeter
13. Measurement of cos phi with voltmeter, ammeter, voltmeter and cosine meter.
14. Measurement of active power in single phase and three – phase network

B Semester

1. Assembly, wiring, control of indicative instruments
2. Measurement of instant and active voltage value with oscillograph
3. Assembly, wiring, control of lighting
4. Assembly and characteristics of limited values marking instruments
5. Making of a simple electrical lighting supply system and power source
6. Panels with three (3) to five (5) lines
7. Wiring, measurements, ground control
8. Making a simple three – phase electric motor supply system
9. Making a simple electrical sewer installation to DC and AC generators network
10. Connection and control of electric DC motor circuits
11. Connection and control of electric AC motor circuits
12. Connection measurements, insulation testing in DC and AC machines
13. Connection, measurements ground and insulation control of transformers
14. Short – circuit test of transformers

Teaching / Facilitating methods

A SEMESTER: TEACHING HOURS 60 (2 THEORY + 2 LABORATORY / WEEK)
B SEMESTER: TEACHING HOURS 75 (2 THEORY + 3 LABORATORY / WEEK)
It is necessary to use the Dynamic Technical Manual.
Moreover: During the theoretical lessons, slides are used more than 20% of teaching hours, as well as audiovisual and other visual material related to the subject, themes and professional environment.
It is recommended to use:

- Slide Projector
- Slideshow Panel
- Whiteboard
- Drawing desk
- Computer with laser and inkjet printer (color), scanner, CD – ROM, high capacity hard drivers, modem, network card
- Electromechanical programs
- Digital projector connected with a computer

Indicative minimum list of equipment for the practical part.

- Measuring instruments. Ammeters, voltmeters, multimeters, watt meter, cosine meter, Megger
- Analog and digital oscillographs, clamp – on ammeter, oscillographs probes, oscilloscope photographic camera
- Different nominal DC and AC current electric machines
- Wheatstone bridge
- Resistors, capacitors and inductors of different nominal sizes
- Power panels. Marking tables. Switchgear, monitoring and control devices
- Laboratory benches with feeding, signaling, switching and safety devices
- Laboratory seats
- Three – phase supply (suitable power kVA). DC power supply or electronic rectifier device. Batteries.
- Electrical tools: test tools, screwdrivers (electric and manual), pliers, wrenches, drills.
- For the laboratory support of all the electrical, engineering and applied – construction courses, an engineering work is suggested to be created in each VET institution, equipped with lathe, milling machines, winding machines etc. Also, a high – voltage generator is good to be installed.

Trainers qualifications:

A) Theoretical part: Diploma or higher education degree, preferably Electrical Engineer with a 5 – year certified experience in this field
B) Laboratory part: Diploma or higher education degree, preferably Electrical Engineer, with a 5- year certified experience in this field or secondary school graduate with a 10 – year experience in this field.

Assessment methods

Assessment method	**Description**	**Assessment criteria**	**Weighted grade**
Written examination	When examining the theoretical part of the certification exam, examinees are asked to reply in writing to a number of questions referred to the theoretical part of the subject of specialization. The duration of the exam is three (3) hours.		
Assessment test (formative assessment)	Each teacher is entitled to examine trainees per module with tests (true / false, multiple choice, matching) of short duration. The tests are evaluated only when attached to the test or to the work of Progress and delivered to the Secretariat of IEK.		The percentage of the grade is determined by the teacher and is announced in advance to trainees.
Essay	The trainer is entitled to delegate work with topics from the taught subject matter. The topics can be gleaned from previous semesters, if this promotes the synthetic and combinatorial skills of the trainees.		The percentage of the grade is determined by the teacher and is announced in advance to

			trainees.
Examination of laboratory	The examinees are asked to carry out a study and/or a structure within the themes of laboratory exercises and a written exam lasting 1.5 hours at the end of the semester.		

Required books:

Authors	Title	Editor	Year	ISBN

Suggested books:

Authors	Title	Editor	Year	ISBN

Erasmus+

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