

DEVELOPING CURRICULUM CONTENT AND OPEN LEARNING MATERIALS FOR THE OCCUPATIONAL CERTIFICATE FOR ELECTRICIANS

OPEN LEARNING TEACHING AND LEARNING RESOURCES AND ASSESSMENT TASKS

Table of contents

[1. Course 1. Electrical Principals 3](#_Toc513150225)

[2. Course 2. Electrical Workmanship and Practice 7](#_Toc513150226)

[3. Course 3. Electrical Systems 9](#_Toc513150227)

[4. Course 4. Wiring of Premises 16](#_Toc513150228)

[5. Course 5. Electrical DC Machines 19](#_Toc513150229)

[6. Course 6. Electrical AC Machines 21](#_Toc513150230)

[7. Course 7. Electronics 25](#_Toc513150231)

The following document provides an overview of each course, associated units, suggested assessment tasks and open learning material identified. Detailed information pertaining to the teaching and learning resources can be found in the storyboards, scripts and text outlines created as part of Deliverable 6.

## Course 1. Electrical Principals

### Overview of topics

1.0 World of Electrician

1.1 Atomic Theory

1.2 Electrical Circuits

1.3 Conductors and Insulators

1.4 Magnetic Theory

1.5 AC Electrical Generation and Distribution

1.6 DC Electrical Generation and Distribution

1.7 Principles of Fault Finding

### Links to units, outcomes and methodology

*For detailed information on the units, outcomes and suggested methodologies for Course 1, please see Appendix A submitted as part of this document.*

### Assessment Tasks: Course 1

**General assessments:**

* Theoretical problems and calculations to be completed.
* Online formative assessment tasks within each unit.
* Practical experiments with reflection questions.
* An online summative assessment at the end of each unit.
* A final online summative assessment at the end of the course.

**Specific assessments per topic[[1]](#footnote-1):**

|  |  |
| --- | --- |
| **Topic**  | **Assessment Details**  |
| 1. World of Electrician
 | * Drag and drop activity
* Share your thoughts- text input
* Multiple choice questions
 |
| 1.1 Atomic Theory | * Drag & drop to complete/compile the ‘Table of the Elements’.
* Make a 3D model of an atom using any available materials.
* Upload a video showing the student explaining ionization.
* Upload a video showing the student building an electrolyte battery.
* Multiple choice questionnaire.
* Matching pairs exercise.
 |
| 1.2 Electrical Circuits | * Drag & drop to link examples of the different components to their function in an electrical circuit.
* Design a simple electrical circuit comprising of each of the basic components. Use the correct IEC symbols in the design.
* Construct a simple circuit using each of the basic components. Film the circuit being switched on and off
* Multiple choice questionnaire.
* Interactive activity where 2 quantities can be varied in a circuit and the third quantity calculated.
* Present case studies of installations in an environment (changing temperatures) constructed using different types of conductors (resistivity). The student must calculate the resistance of the conductors in these installations.
* Student to submit photographs of appliances such as heaters, kettles etc. The student must use the information on the appliance (voltage and power ratings) to determine the current drawn when the appliance is on.
 |
| 1.3 Conductors and Insulators | *Assessment details to be determined in consultation with Subject Matter Experts*  |
| 1.4 Magnetic Theory | * Answer the following question:

What happens when;-The magnet is moved-The magnet is moved faster-The coil is moved-The coil and magnet are moved together-The length of the conductor is increased -E = BlV* Explain how B, l and velocity affect EMF
* Multiple choice
* Computer based calculation
 |
| 1.5 AC Electrical Generation and Distribution | WorksheetComputer based calculation |
| 1.6 DC Electrical Generation and Distribution | *Assessment details to be determined in consultation with Subject Matter Experts* |
| 1.7 Principles of Fault Finding | *Assessment details to be determined in consultation with Subject Matter Experts* |

### Open learning and teaching resources: *\* Note: Some of these resources may need to be adapted depending on the licencing conditions of each resource.*

|  |  |  |
| --- | --- | --- |
| **Topic**  | **Resource Details**  | **Link to resource** |
| 1. World of Electrician
 | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |
| 1.1 Atomic Theory | Video explaining concepts relating to matter.Videos explaining ionization.Video explaining the factors that influence the resistance of a conductor.PHET Simulation- Building atomsPHET Simulation- Covalent and Ionic SubstancesVideo explain metallic bonding PHET Simulations- Conductors and Insulators | <https://youtu.be/wyRy8kowyM8><https://youtu.be/5CBs36jtZxY><https://youtu.be/GhbuhT1GDpI><https://youtu.be/bzgfzw0YStY><https://phet.colorado.edu/en/simulation/build-an-atom><https://phet.colorado.edu/en/simulation/legacy/sugar-and-salt-solutions><https://www.youtube.com/watch?v=Bjf9gMDP47s> <https://phet.colorado.edu/en/simulation/legacy/conductivity> |
| 1.2 Electrical Circuits | Video explaining the factors that influence the resistance of a conductor. | <https://youtu.be/bzgfzw0YStY> |
| 1.3 Conductors and Insulators | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |
| 1.4 Magnetic Theory | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |
| 1.5 AC Electrical Generation and Distribution | Animation:Generator - conductor rotates and magnet is stationaryAlternator - conductor is stationary and the coils rotate | <https://www.slideshare.net/PurushottamKumar25/types-of-alternator-its-application><https://www.slideshare.net/PurushottamKumar25/types-of-alternator-its-application> |
| 1.6 DC Electrical Generation and Distribution | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |
| 1.7 Principles of Fault Finding | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |

### Exemplar storyboard

Click on this link to view an exemplar storyboard for Topic 1 World of Electricians: Unit 1 World of Electrician: <https://www.dropbox.com/s/firf64w0i4lvlcx/01_01_01_What%20is%20an%20electrician_V2.pptx?dl=0>

## Course 2. Electrical Workmanship and Practice

### Units

2.1 Safety

2.2 Code of Practice

2.3 Basic Hand Tools

2.4 Basic Power Tools

### Links to units, outcomes and methodology

*Detailed information on the units, outcomes and suggested methodologies are currently being developed for Course 2 in consultation with Subject Matter Experts.*

### Assessment Tasks: Course 2

**General assessment:**

A series of progressively more complex fabrication assignments.

**Specific assessments per topic[[2]](#footnote-2):**

|  |  |
| --- | --- |
| **Topic**  | **Assessment Details**  |
| 2.1 Safety | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 2.2 Code of Practice | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 2.3 Basic Hand Tools | * Practical Project 1- Fit a new plug to an appliance
* Practical Project 2- Replace a wall socket
* Practical Project 3- Wire an out building
* Practical Project 4- Manufacture a lock out calliper
 |
| 2.4 Basic Power Tools | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |

### Open learning and teaching resources: *\* Note: Some of these resources may need to be adapted depending on the licencing conditions of each resource.*

|  |  |  |
| --- | --- | --- |
| **Topic**  | **Resource Details**  | **Link to resource** |
| 2.1 Safety | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |
| 2.2 Code of Practice | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |
| 2.3 Basic Hand Tools | Merseta Course Materials Welding, gas and braising information  | <https://www.dropbox.com/sh/mn0gs3j9jn9904b/AAC7BXvjuds-LUwUYm9KdlZKa?dl=0><http://www.substech.com/dokuwiki/doku.php?id=principles_of_arc_welding><http://www.substech.com/dokuwiki/doku.php?id=classification_of_welding_processes><http://www.substech.com/dokuwiki/doku.php?id=shielded_metal_arc_welding_smaw><http://www.substech.com/dokuwiki/doku.php?id=metal_inert_gas_welding_mig_gmaw><http://www.substech.com/dokuwiki/doku.php?id=submerged_arc_welding_saw><http://www.substech.com/dokuwiki/doku.php?id=gas_welding_gw><http://www.substech.com/dokuwiki/doku.php?id=brazing> |
| 2.4 Basic Power Tools | Government of Australia – Prepare and Operate Equipment, Tools andMachinery – PowerTools | <https://www.dropbox.com/s/9mshzrmoegv0vdq/Powertools.PDF?dl=0> |

### Exemplar storyboard

Click on this link to view an exemplar storyboard for Topic 2 Basic Hand Tools: Types, Uses and Care of Hand Tools

 <https://www.dropbox.com/s/s6utcew1skjlekd/02_03_01_Basic%20Hand%20Tools.pptx?dl=0>

## Course 3. Electrical Systems

### Units

3.1 Cables and Conductors

3.2a Single Phase Components

3.2b Three Phase components

3.3 Low Voltage Circuit Protection

3.4 Earthing and Bonding

3.5 Load Balancing

3.6a Single Phase Metering Systems

3.6b Three Phase Metering Systems

3.7 Industrial Lighting Circuits

### Links to units, outcomes and methodology

*For detailed information on the units, outcomes and suggested methodologies for Course 3, please see Appendix B submitted as part of this document.*

### Assessment Tasks: Course 3

**General assessments:**

* Online formative assessment tasks within each unit.
* Practical assignments with reflection questions requiring a demonstration of competence
* An online summative assessment at the end of each unit.
* A final online summative assessment at the end of the course.

**Specific assessments per topic[[3]](#footnote-3):**

|  |  |
| --- | --- |
| **Topic**  | **Assessment Details**  |
| 3.1 Cables and Conductors | * Label various sketches of cables and conductors
* Drag and drop cables
* Multi-choice answers/ questions
* Circuit Diagrams and sketches
* Worksheet: Explain various regulations pertaining to:
* Cables and Conductors
* Questionnaire
* Multi-choice answer work sheet
* Labelling of sketches
 |
| 3.2a Single Phase Components | * Label various sketches of disconnectors
* Select a Data Sheet and formulate questions
* Label various sketches of relays
* Label various sketches of timers
* Label various sketches of timers
* Describe the operation of the various disconnectors (voice note to be uploaded)
* Describe the operation of the various Relays (voice note to be uploaded)
* Describe the operation of the various timers (voice note to be uploaded)
* Describe the operation of the various contactors (voice note to be uploaded)
* Worksheet: Identify symbol and its use.
* Worksheet: Explain various regulations pertaining to:
* Disconnectors, Relays, Timers, Contactors
 |
| 3.2b Three Phase components | * Worksheet: Design a circuit for connectors under different scenarios
* Possibly: Drag and Drop interactive circuit
* Worksheet: Design a circuit with relay under different scenarios
* Worksheet: Design a circuit with timers under different scenarios
* Worksheet: Design a circuit with contactors under different scenarios
* Worksheet: Design a circuit with different types of disconnectors, relays, timers and contactors under different scenarios
 |
| 3.3 Low Voltage Circuit Protection | * Label various sketches of Circuit Breakers
* Label various sketches of Earth Leakage units
* Label various sketches of Fuses
* Label various sketches of Surge Arrestors
* Label various sketches of Overload Relays
* Describe the operation of the various Circuit Breakers (voice recording to be uploaded)
* Describe the operation of the various Earth Leakage Units (voice recording to be uploaded)
* Describe the operation of the various Fuses (voice recording to be uploaded)
* Describe the operation of the various Surge Arrestors (voice recording to be uploaded)
* Describe the operation of the various Overload relays (voice recording to be uploaded)
* Worksheet: Identify symbol and its use.
* Worksheet: Explain various regulations pertaining to:
* Circuit Breakers, Earth Leakage Units, Fuses and Surge Arrestors
* Worksheet: Design a circuit for Circuit Breakers under different scenarios
* Worksheet: Design a circuit with Earth Leakage Units under different scenarios
* Worksheet: Design a circuit with Fuses under different scenarios
* Worksheet: Design a circuit with Surge Arrestors under different scenarios
* Worksheet: Design a circuit with Overload Relays under different scenarios
* Worksheet: Design a circuit with different types of Circuit Breakers, Earth Leakage Units, Fuses, Surge Arrestors and Overload relays under different scenarios
 |
| 3.4 Earthing and Bonding | * Multichoice questions and answers
* Label diagram
* Sketch diagrams
 |
| 3.5 Load Balancing | * Draw and label a sketch
* Calculate the power for each phase
 |
| 3.6a Single Phase Metering Systems | * Label sketches of single phase
* Multichoice question and answer
 |
| 3.6b Three Phase Metering Systems | * Label sketches of three phase meter
* Multichoice question and answer
 |
| 3.7 Industrial Lighting Circuits | *Assessment details to be determined in consultation with Subject Matter Experts* |

### Open learning and teaching resources: *\* Note: Some of these resources may need to be adapted depending on the licencing conditions of each resource.*

|  |  |  |
| --- | --- | --- |
| **Topic**  | **Resource Details**  | **Link to resource** |
| 3.1 Cables and Conductors | Explanation, sketches and, videos, Interactive mediaLink to transportation methods of cablesVarious types of Cables and UsesProperties of cables / Advantages and disadvantagesManufacturers Specifications- Methods of jointingManufacturers Specifications- Different types of jointing kits | [http://www.aberdare.co.za/#](http://www.aberdare.co.za/)<http://www.africancables.com/products-list-page><http://www.aberdare.co.za/product-categories/transport/><http://www.africancables.com/products-list-page><http://www.africancables.com/node/350><https://www.hellermanntyton.com/competences/cable-jointing><https://www.hellermanntyton.com/competences/cable-jointing#tab2> |
| 3.2a Single Phase Components | Circuit breakersCircuit Drawings, IEC Symbol Chart,  | <http://cbi-lowvoltage.co.za/content/circuit-breakers-equipment><https://electronicsclub.info/circuitsymbols.htm> |
| 3.2b Three Phase components | What is a circuit breaker All types of circuit protectionTypes and applications of fusesWhat is a fuseBasic operation of RelayOperation and ConstructionBasic Operations Relays and Solenoids | <https://www.youtube.com/watch?v=P3x2tvmgkjg><http://cbi-lowvoltage.co.za/products?page=1><http://cbi-lowvoltage.co.za/content/earth-leakage-products><https://www.youtube.com/watch?v=3HQG3W6PolU><https://www.youtube.com/watch?v=l-PELXho72E><https://www.youtube.com/watch?v=1_YfuH_AcxQ><https://www.youtube.com/watch?v=kI_YzNOrG8g><https://www.youtube.com/watch?v=i3lGy3MjUhY> |
| 3.3 Low Voltage Circuit Protection | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |
| 3.4 Earthing and Bonding | Differences between earthing and bonding  | https://www.youtube.com/watch?v=odnUIWyC0oU<http://www.brightlec.co.uk/the-difference-between-earthing-and-bonding/><http://www.assuredelectricalwales.co.uk/electrical-services/earthing-and-bonding-explained/><http://pages.nxtbook.com/nxtbooks/Cablofil/Legrand_wiremeshtray_techguide/iphone/cablofil_legrand_wiremeshtray_techguide_p0016_hires.jpg>  |
| 3.5 Load Balancing | Load balancing 3 phase load connections  | [https://en.wikipedia.org/wiki/Load\_balancing\_(electrical\_power)](https://en.wikipedia.org/wiki/Load_balancing_%28electrical_power%29) <https://www.electronicshub.org/wp-content/uploads/2015/11/Single-and-three-phase-load-connection.jpg> |
| 3.6a Single Phase Metering Systems |  | <http://electrialstandards.blogspot.co.za/2014/07/energy-meter-working-principle.html><http://www.electrical-engineering-assignment.com/wp-content/uploads/2014/02/102.png> |
| 3.6b Three Phase Metering Systems |  | <https://en.wikipedia.org/wiki/Electricity_meter><https://www.allsyllabus.com/aj/note/ECE/ELECTRONIC%20INSTRUMENTATION/Unit4/THREE%20PHASE%20ENERGY%20METER.php#.WkzIftKwcdU> <http://electrical-engineering-portal.com/overview-of-single-phase-induction-type-energy-meter><http://book.transtutors.com/cmsimg/10343_single%20phase%20induction%20energy%20meters.jpg> <https://electricaltechnology.org/wp-content/uploads/2012/11/httpelectricaltechnology1.blogspot.com_3.png>  |
| 3.7 Industrial Lighting Circuits |  | <https://en.wikipedia.org/wiki/Fluorescent_lamp><http://www.studyelectrical.com/2014/05/how-fluorescent-tube-lights-work.html><https://www.youtube.com/watch?v=kLEHNYWQl68><https://en.wikipedia.org/wiki/Mercury-vapor_lamp><http://www.lamptech.co.uk/Documents/M1%20Introduction.htm><https://www.youtube.com/watch?v=Qi6rXkJjDQw><https://en.wikipedia.org/wiki/Sodium-vapor_lamp><http://www.lamptech.co.uk/Documents/SO%20History%20MV-SE.htm><https://www.youtube.com/watch?v=hArNwYgRgL4><https://en.wikipedia.org/wiki/Neon_lamp><https://www.amazon.com/Lychee-Neon-Light-Wire-Battery/dp/B00EENNHMM><https://www.youtube.com/watch?v=cHdcM2PftUQ><https://en.wikipedia.org/wiki/Light-emitting_diode><http://zeiss-campus.magnet.fsu.edu/tutorials/leddiagram/indexflash.html><https://www.youtube.com/watch?v=WjvUVjuHRtc><https://en.wikipedia.org/wiki/Halogen_lamp><https://www.thelightbulb.co.uk/resources/guide-buying-halogen/><https://www.youtube.com/watch?v=2W7I06nvMLM> <https://en.wikipedia.org/wiki/High-mast_lighting><https://dir.indiamart.com/hyderabad/high-mast-lighting.html><http://www.cuphosco.com/high-mast-lighting-manufacturer><http://www.valmont.in/products/lighting/high-mast-lighting><http://www.nezonegroup.com/high-mast-poles/><http://www.mayfair.net.in/high-mast-poles.html><https://www.youtube.com/watch?v=1iqL0-fcYmA> |

### Exemplar storyboard

Click on this link to view an exemplar storyboard for Course 3: Topic 1 Unit1: Introduction to Cables <https://www.dropbox.com/s/xw8302lvttatdvg/03_01_01_Introduction%20to%20cables.pptx?dl=0>

## Course 4. Wiring of Premises

### Overview of topics

**Introduction to Wireways**

Definition of wireways

The 8 planning steps

**Domestic Installation:**

1. Gate Motor
2. Geyser
3. Security Lighting
4. Stove

**Commercial Installation:**

1. 3 phase socket outlet
2. 3 phase supply to motor control panel

### Methodology

As this topic is a highly practical one, the required information is structured in such a way that the learners will actively participate in the learning as opposed to simply learning theory without application.

There are 6 scenarios in total, 4 scenarios covering domestic installation, while the other 2 scenarios introduce the learners to commercial installations. These scenarios are all structured to follow an 8-step installation process. The scenarios will be presented in the form of an interactive map and the learner is free to complete the scenarios in any order that they choose.



*Example of interactive map*

To prepare the learners to be able to successfully work through the scenarios there is an additional supportive unit entitled “Introduction to Wireways” where learners can choose to work through the 8 installation steps using the relatable example of making pizzas for a client or they can listen to some useful advice from a Master Electrician for each of the 8 installation steps.



*Click on the image to view Introduction to Wireways interactive lesson*

Within the 8-step installation process, learners are presented with three different options as to how they could complete each scenario. The best option, a good option and a non-viable option. Learners need to use their own critical thinking skills as well as the information provided to choose the best option for completing the task. Once they have chosen the option that they think would work best, they provided with constructive feedback, depending on which option they chose. The learner is then guided through the best option with step by step instructions for completing the task.

### Assessment Tasks: Course 4

The assessments tasks are similar for each of the 6 scenarios and are as follows:

* Audio recordings with information that learner needs to take note of (client brief information)
* Multiple-choice question to check learner comprehension (formative assessments)
* Working through 3 options to determine which is the best option for the task at hand
* Drawing diagrams of how they will complete the installation
* Creating an installation plan to determine tools, materials, time and labour required
* Working through the entire scenario successfully will be considered a form of summative assessment
* Learners will be required to demonstrate competence in physically being able to complete the installation task during a practical assessment at a testing centre.

### Open learning and teaching resources:

*To date, no open resources have been identified for this topic, this section will be updated as resources are identified.*

### Exemplar storyboard

Click on this link to view an exemplar storyboard for Course 4: Scenario 1: Wireways: Step 1: <https://www.dropbox.com/s/n1e5h6or8fsrvbk/04_01_01_Gate%20Motor%20Supply.pptx?dl=0>

## Course 5. Electrical DC Machines

### Overview of topics

5.1 Principles of DC Motors

5.2 Applications of DC Motors

### Links to units, outcomes and methodology

*For detailed information on the units, outcomes and suggested methodologies for Course 5, please see Appendix C submitted as part of this document.*

### Assessment Tasks: Course 5

**General assessments:**

* Various theoretical problems and calculations to be completed.
* Various online formative assessment tasks within each unit.
* Various practical scenarios requiring application of knowledge and skills.
* Final online summative assessment at the end of the course.

**Specific assessments per topic[[4]](#footnote-4):**

| **Topic**  | **Assessment Details**  |
| --- | --- |
| 5.1 Principles of DC Motors | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 5.2 Applications of DC Motors | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |

### Open learning and teaching resources: *\* Note: Some of these resources may need to be adapted depending on the licencing conditions of each resource.*

|  |  |  |
| --- | --- | --- |
| **Topic**  | **Resource Details**  | **Link to resource** |
| 5.1 Principles of DC Motors | Construction and Working of DC Motor Electrical | https://www.youtube.com/watch?v=IC-PWxtcirI |
| 5.2 Applications of DC Motors | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |

### Exemplar storyboard

Click on this link to view an exemplar storyboard for Topic 1 Unit 2 How DC Motors Work

<https://www.dropbox.com/s/2ckqal79wfp21lj/05_01_02_How%20DC%20motors%20work.pptx?dl=0>

## Course 6. Electrical AC Machines

### Overview of topics

6.1 Revision of the Electromagnetic Effect

6.2 Three Phase AC Induction Motors – operation, construction, types, application

6.3 Single Phase AC Induction Motors – operation, construction, types, application

6.4 Single and Three Phase AC Synchronous Motors – operation, construction, types, application

6.5 Scenario 1: Direct On-line Starter and Control Circuits – switches, sensors, timers

6.6 Scenario 2: Single and Three Phase Reversing Starter

6.7 Scenario 3: Star-Delta Starter 1– manual and semi-automatic

6.8 Scenario 4: Star-Delta Starter 2 – automatic

6.9 Scenario 5: Single and Three Phase Speed Control

6.10 Scenario 6: Resistance and Auto-Transformer Starter

6.11 Scenario 7: Three Phase Pole Changing Starter

6.12 Scenario 8: Cleaning

6.13 Scenario 9: Electrical Failure

6.14 Scenario 10: Mechanical Failure

6.15 Alternators and Generators – differences, types, operation, construction, application

6.16 Testing and Protection of Alternators and Generators

6.17 Calculations with Alternators and Generators

6.18 Single Phase Transformers – operation, construction, types, application

6.19 Three Phase Transformers – operation, construction, types, application

6.20 Calculations with Transformers

### Links to units, outcomes and methodology

*For detailed information on the units, outcomes and suggested methodologies for Course 6, please see Appendix D submitted as part of this document.*

### Assessment Tasks

**General assessments:**

* Various theoretical problems and calculations to be completed.
* Various online formative assessment tasks within each unit.
* Various practical scenarios requiring application of knowledge and skills.
* An online summative assessment at the end of each unit.
* A final online summative assessment at the end of the course.

**Specific assessments per topic[[5]](#footnote-5):**

| **Topic**  | **Assessment Details**  |
| --- | --- |
| 6.1 Revision of the Electromagnetic Effect | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.2 Three Phase AC Induction Motors – operation, construction, types, application  | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.3 Single Phase AC Induction Motors – operation, construction, types, application  | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.4 Single and Three Phase AC Synchronous Motors – operation, construction, types, application | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.5 Scenario 1: Direct On-line Starter and Control Circuits – switches, sensors, timers | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.6 Scenario 2: Single and Three Phase Reversing Starter | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.7 Scenario 3: Star-Delta Starter 1– manual and semi-automatic | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.8 Scenario 4: Star-Delta Starter 2 – automatic | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.9 Scenario 5: Single and Three Phase Speed Control | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.10 Scenario 6: Resistance and Auto-Transformer Starter | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.11 Scenario 7: Three Phase Pole Changing Starter | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.12 Scenario 8: Cleaning | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 6.13 Scenario 9: Electrical Failure | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |

### Open learning and teaching resources: *\* Note: Some of these resources may need to be adapted depending on the licencing conditions of each resource. For a comprehensive list of resources please see links on Appendix D.*

|  |  |  |
| --- | --- | --- |
| **Topic**  | **Resource Details**  | **Link to resource** |
| 6.1 Revision of the Electromagnetic Effect | *Electromagnetism*Lenz LawElectromagnetism  | <https://youtu.be/-v8MYAFl7Mw><https://youtu.be/uGUsTWjWOI8><https://youtu.be/OR8G1CAoL2c> |
| 6.2 Three Phase AC Induction Motors – operation, construction, types, application  | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |
| 6.3 Single Phase AC Induction Motors – operation, construction, types, application  | Repulsion induction model Shaded pole induction model Starting phase of split induction model Single phase AC induction models  | <https://youtu.be/wTLZM0xlkr4><https://youtu.be/PmNcRsxSovs><https://youtu.be/FYxkInpmRNI><https://youtu.be/B51tmHatt-E> |
| 6.4 Single and Three Phase AC Synchronous Motors – operation, construction, types, application | Induction motor vs synchronised motorStarting methods of synchronised motorsABB synchronise  | <https://youtu.be/QctagHJ8-_w><https://youtu.be/80uxMISyzxI><https://youtu.be/dALlcl6HC4E> |
| 6.5 Scenario 1: Direct On-line Starter and Control Circuits – switches, sensors, timers | Proficad video tutorial Training Centre Learning Materials  | <https://youtu.be/NuTud9j2T4w><https://www.dropbox.com/s/v0yc74tsuxg6s95/1.%20Wire%20Sequence>%20Starters%20%20Part%202.pdf?dl=0 |
| 6.6 Scenario 2: Single and Three Phase Reversing Starter | Control circuit forward and reverseAutomatic reverse | <https://youtu.be/uNygpiG7SGU><https://youtu.be/IuBW_pudLNg> |
| 6.7 Scenario 3: Star-Delta Starter 1– manual and semi-automatic | Star delta timer | <https://youtu.be/J7VLlUbp34k> |
| 6.8 Scenario 4: Star-Delta Starter 2 – automatic | How to wire a star delta motor | <https://youtu.be/n_QPVEdaBgw> |
| 6.9 Scenario 5: Single and Three Phase Speed Control | Basic understanding of variable frequency drives | <https://youtu.be/3-cs4eEiBWo> |
| 6.10 Scenario 6: Resistance and Auto-Transformer Starter | Korndorfer transformer | <https://youtu.be/ZLrqn85_6aA> |
| 6.11 Scenario 7: Three Phase Pole Changing Starter | Two speed motor starter | <https://youtu.be/ntXg1jJy-GU> |
| 6.12 Scenario 8: Cleaning | *To date, no open resources have been identified for this topic, this section will be updated as resources are identified.* |  |
| 6.13 Scenario 9: Electrical Failure | Electric motor insulation failure | <https://youtu.be/6FXTBYIvr3Q> |

### Exemplar storyboard

Click on this link to view an exemplar storyboard for Topic 1 Unit 2 How Three Phase AC Induction Motors Work

<https://www.dropbox.com/s/hlqiaez3felxa5x/06_02_02_How%20three%20phase%20AC%20induction%20motors%20work.pptx?dl=0>

## Course 7. Electronics

### Overview of topics

7.1 Introduction to Electronics

7.2 Circuit Basics

7.3 Resistors

7.4 Variable Resistors

7.5 Diodes Part 1

7.6 Diodes Part 2

7.7 Capacitors and Inductors

7.8 RC, RL and RCL Circuits

7.9 Transistors

7.10 Integrated Circuits

7.11 Build your own AC to DC Power Supply

7.12 Try a Project

### Assessment Tasks

**General assessments:**

* Theoretical problems and calculations to be completed.
* Online formative assessment tasks within each unit.
* A series of progressively more complicated circuits to be built and analysed.
* A set of practical electronics projects to be built.
* An online summative assessment at the end of each unit

**Specific assessments per topic[[6]](#footnote-6):**

| **Topic**  | **Assessment Details**  |
| --- | --- |
| 7.1 Introduction to Electronics | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.2 Circuit Basics | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.3 Resistors | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.4 Variable Resistors | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.5 Diodes Part 1 | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.6 Diodes Part 2 | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.7 Capacitors and Inductors | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.8 RC, RL and RCL Circuits | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.9 Transistors | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.10 Integrated Circuits | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.11 Build your own AC to DC Power Supply | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |
| 7.12 Try a Project | * *Assessment details to be determined in consultation with Subject Matter Experts*
 |

### Open learning and teaching resources: *\* Note: Some of these resources may need to be adapted depending on the licencing conditions of each resource.*

|  |  |  |
| --- | --- | --- |
| **Topic**  | **Resource Details**  | **Link to resource** |
| 7.1 Introduction to Electronics | Electronics for dummies | <https://www.dropbox.com/s/wtmp1f1nlq76fcd/Electronics%20for%20Dummies.pdf?dl=0> |
| 7.2 Circuit Basics | Electronics classBasic Electronics  | <https://www.dropbox.com/s/8mboq9v07t4u4xa/Electronics-Class.pdf?dl=0><https://www.dropbox.com/s/0avfc3oxvrjidjr/Basic-Electronics.pdf?dl=0> |
| 7.3 Resistors | Umfolozi TVET College Materials  | <https://www.dropbox.com/s/nyb2y6mt00unlw0/1.%20BE-01%20IDENTIFY%20RESISTORS%20Ver%202017.pdf?dl=0> |
| 7.4 Variable Resistors | Materials pertaining to Course 7 | <https://www.dropbox.com/sh/ksjz5u45r9lbw1g/AADEhYOdFfvYycYfJnZBqFqva?dl=0> |
| 7.5 Diodes Part 1 | Materials pertaining to Course 7 | <https://www.dropbox.com/sh/ksjz5u45r9lbw1g/AADEhYOdFfvYycYfJnZBqFqva?dl=0> |
| 7.6 Diodes Part 2 | Materials pertaining to Course 7 | <https://www.dropbox.com/sh/ksjz5u45r9lbw1g/AADEhYOdFfvYycYfJnZBqFqva?dl=0> |
| 7.7 Capacitors and Inductors | Materials pertaining to Course 7 | <https://www.dropbox.com/sh/ksjz5u45r9lbw1g/AADEhYOdFfvYycYfJnZBqFqva?dl=0> |
| 7.8 RC, RL and RCL Circuits | Materials pertaining to Course 7 | <https://www.dropbox.com/sh/ksjz5u45r9lbw1g/AADEhYOdFfvYycYfJnZBqFqva?dl=0> |
| 7.9 Transistors | Materials pertaining to Course 7 | <https://www.dropbox.com/sh/ksjz5u45r9lbw1g/AADEhYOdFfvYycYfJnZBqFqva?dl=0> |
| 7.10 Integrated Circuits | Materials pertaining to Course 7 | <https://www.dropbox.com/sh/ksjz5u45r9lbw1g/AADEhYOdFfvYycYfJnZBqFqva?dl=0> |
| 7.11 Build your own AC to DC Power Supply | Materials pertaining to Course 7 | <https://www.dropbox.com/sh/ksjz5u45r9lbw1g/AADEhYOdFfvYycYfJnZBqFqva?dl=0> |
| 7.12 Try a Project | Materials pertaining to Course 7 | <https://www.dropbox.com/sh/ksjz5u45r9lbw1g/AADEhYOdFfvYycYfJnZBqFqva?dl=0> |

### Exemplar storyboard

Click on this link to view an exemplar storyboard for Topic 3 Unit 2 Getting familiar with resistors

<https://www.dropbox.com/s/85z58pg8fdnsi25/07_03_01_Getting%20Familiar%20with%20Resistors.pptx?dl=0>

1. These assessments are currently being refined with the assitance of Subject Matter Experts. [↑](#footnote-ref-1)
2. These assessments are currently being refined with the assitance of Subject Matter Experts. [↑](#footnote-ref-2)
3. These assessments are currently being refined with the assitance of Subject Matter Experts. [↑](#footnote-ref-3)
4. These assessments are currently being refined with the assitance of Subject Matter Experts. [↑](#footnote-ref-4)
5. These assessments are currently being refined with the assitance of Subject Matter Experts. [↑](#footnote-ref-5)
6. These assessments are currently being refined with the assitance of Subject Matter Experts. [↑](#footnote-ref-6)