

**WELCOME to your New Zealand Certificate in Electrical Engineering Theory level 3 course 2020**

Your lead theory tutors are **Neil Parker Bart Milne and Graham Paine**

- Qualified electricians
- Adult education qualifications
- Adult numeracy and literacy qualifications
- Electrical engineering qualifications
- Industry trained and experienced

**Behavioural expectations in class**

- Mutual respect
- Questions welcomed for clarification
- Attentiveness required when teaching is in progress
- No undue disruptive behaviour
- Attendance required at all lessons
- No cell phone distraction in class, please use them outside class
- No eating in classrooms, water bottles allowed
- Punctual for classes
- Phone or text your tutor if unable to attend a class

**To improve your chances of a successful year you will need to**

- Organise your tutorial notes in a folder for studying.
- Read your notes between classes and revise/study for assessments.
- Complete homework assignments on time.
- Bring your current topic notes, maths workbook, paper, pens, pencils, rule and Casio calculator to lessons.

**Course outline**
See separate handout

Please advise your tutor in confidence if you have any special requirements with sight, hearing, learning disabilities, or any special needs so that we can discuss options for your best learning outcomes.

# Becoming an Electrician

**Entry requirements**

To become an electrician you need to complete an apprenticeship and gain a National Certificate in Electrical Engineering (Year3) or a National Certificate in Electricity Supply (Year 3).

These apprenticeships involve **off job** unit standard theory work through a training provider such as a polytechnic.

During your apprenticeship you are supervised by a registered electrician and your practical skills assessed and passed by your supervisor and registered as **on job** unit standards by Skill NZ.

Apprenticeships usually take three to four years to complete.
A registration electrician theory exam and a regulation exam must be passed.

Qualified electricians need to be registered with the Electrical Workers Registration Board.

Electrician apprenticeships are also part of the New Zealand Apprenticeships scheme.

**Secondary education**

Useful school subjects include Maths, English, Science and Technology subjects that promote hand tool use.

For an apprenticeship, it is preferred that you have at least three years secondary education. For Year 11 to 13 students, Gateway programme is a good way to gain industry experience.

**Personal requirements**

Electricians need to be:

Accurate, methodical and good at problem-solving

Practical and logical

Able to work well independently or in a team

Safety-conscious and physically fit.

**How many people work as electricians**

There are around 18000 registered electricians working in New Zealand and there is expected to be a demand for around another 4000 more over the next 3 years.

**What are the chances of getting a qualified job?**

Chances of finding work as a qualified electrician are good, particularly in Auckland and Christchurch.

Demand for electricians is good due to a strong building sector and the amount of building work being undertaken has been steadily increasing

There is a stable maintenance and repair work market

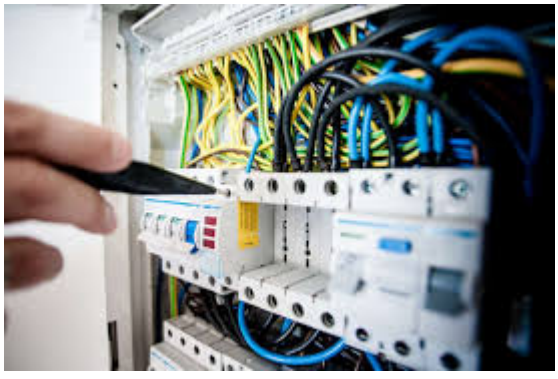
Low levels of people completing apprenticeships during the recession increased has demand.

The number of consents issued for new dwellings reached a record high and has tripled over the last 6 years. The amount of building work being undertaken is expected to continue to increase, along with demand for qualified electricians.
Much of this work will be in Auckland and Christchurch. However, work is also picking up in other regions such as Waikato, Bay of Plenty, Wellington, and Nelson.

Electrical apprenticeships are increasing in some regions.
Although the Gateway programmes and pre-trade courses can lead to apprenticeships, some employers prefer to train candidates themselves. Because of this, it's a good idea to talk with local employers before enrolling in a course.

Electrician as an occupation is on the skill shortage lists
Electrician appears on Immigration New Zealand's long-term skill shortage list, which means the Government is actively encouraging qualified electricians from overseas to work in New Zealand.

Most electricians work for small businesses or are self-employed
Most electricians work for electrical contracting businesses.
About 75% of these businesses are sole traders or small companies employing fewer than five staff.



Industrial and specialist electricians work for businesses in a wide range of areas, including:
the dairy industry,
boat building,
the petrochemical industry
(oil rigs and refineries)
and the electricity supply and manufacturing industries.

**Pay**

Pay for electricians vary, but most earn between $40,000 and $70,000 a year.

Apprentices may start out on the minimum training rate. Pay increases as they pick up skills or complete unit standards. At the end of their four-year apprenticeship, an electrician can expect to earn about $40,000 a year.

In their first two years after completing their apprenticeship, electricians usually earn between $45,000 - $48,000.

With three to five years' experience, electricians usually earn $50,000 - 55,000.

With six or more years' experience, electricians usually earn $58,000 - $70,000.

Experienced electricians working in specialist fields or running their own business can earn $80,000-100,000 a year or more.

**Electricians:**

Usually work regular hours, but may have to work weekends and be on call.
They work on buildings that are under construction, being repaired or altered.
They may also work at power stations, substations and other places where high voltage equipment is being used.

**What tasks do electricians carry out**

Install electrical wiring and equipment
Repair or replace electrical wiring, parts and equipment
Study and interpret wiring diagrams and floor plans
Test electrical work for safety
Keep records of problems they find with electrical equipment and the servicing they carry out
Prepare quotes for clients and keep a record of work done.
Self-employed electricians will also need to run their own business.

**Skills and knowledge electricians need to have:**

knowledge of electrical theory
knowledge of electrical legislation, codes, and standards of practice
knowledge of how to install electrical wiring and fixtures
the ability to read and interpret wiring diagrams and floor plans
basic maths and physics skills
knowledge of safety procedures and first aid.
Electricians who run their own businesses must have small business skills.

**Getting an apprenticeship**

Obtaining an apprenticeship is easier if you have the right start. Use any contacts in your social circles to obtain an interview. Visit electrical firms and offer yourself for job experience.
Start a full or part-time electrical course at WelTec. Enquire at ETCO.

Updated February 2020

# Pathway to registration as an electrician by a Skills NZ trainee studying at night class

**Signed training agreement between trainee, employer and Skills NZ**

**Year 1**

**Pass the following units at Weltec**

a) US6401 first aid
b) US6402 CPR
c) US29465 safe working practices
d) US15852 isolate and test

The above units are required by the Electrical Workers Registration Board allowing them to issue you with a trainee license. This license names your supervisor and allows you to work and train towards your registration. This is valid for 4 years.

**Pass the balance of the year 1 units**

Please note that any year1 units not credited as passed in this year will need to be assessed and repurchased in following years and may delay your registration

**Attend a 2 week full time block course at Weltec**

**Employer to sign off any Skills NZ task book skills that have been demonstrated to on job unit standards**

**Year 2 & 3**

**Each year pass all off job units at Weltec, attend a block course and have employer sign off the balance of on job Skill NZ tasks in task book**

**At the end of year 2 sit and pass a capstone exam set by Skills NZ ( 60% pass )**

**Sit and pass the external electrician theory exam set by the electrical workers registration board via ASPEQ ( 60% pass )**

**Sit and pass the external electrician regulations exam set by the electrical workers registration board via ASPEQ ( 60% pass )**

**Finally apply to the electrical workers registration board for registration. They will require the following.**

1) **All off job units credited on the NQF year 1, 2 and 3**
2) **Skills NZ- employer task book completed**
3) **Both external exams passed**
4) **Current first aid and CPR certificate**

**Where does your full time 1 year course fit into this.**

**The full time L3 certificate is designed to give the first two years of theory, leaving only one year of night classes to complete the theory delivery.**

**Achieving the L3 certificate incorporating the capstone examination pass will allow Skills NZ to cross credit the certificate to the unit standards.**

**Advancing to year 3 can only be allowed by gaining an apprenticeship and signing a training agreement with Skills NZ.**

**The practical skills gained on the full time 1 year certificate course will make it easier to progress through the skill tasks in the Skills NZ on job units log book. A certificate holder will also be more attractive to an employer as opposed to a candidate straight from college.**

**A trainee license will still be required.**

**The practical on job unit standards signed off by the employer will need to be completed when you gain an apprenticeship.**

**Registration exams will still need to be passed and application to the registration board made to become registered as an electrician.**

Whitireia NEW ZEALAND

WelTec
Te Whare Wānanga o te Awakairangi

skills.

ELECTRICAL WORKERS REGISTRATION BOARD
SAFETY | COMPETENCY | COMPLIANCE

**2020**

# Stationery list 2020 L3 Electrical

The following items are required to be purchased for your course immediately and brought to each lesson.

Lined A4 refill
Ring binder
Subject dividers
Clear film pocket folder
Pencil
Pencil sharpener
Eraser
Pens
Ruler 150mm
Compass
Protractor
Calculator FX82ms or FX82AU plus
Highlighters ( 3 colours )

Warehouse stationery often has good prices for these items.

# New Zealand Certificate in Electrical Engineering Theory (Level 3)

## Course content and assessment 2020

**New Zealand Certificate in Electrical Engineering Theory (Level 3)**

**Course content and assessment**

Your program of study is divided into 8 separate courses as shown in the table below

| Course | Course Title | Level | Credits |
|---|---|---|---|
| EE3102 | Electrical Work Practices | 3 | 15 |
| EE3103 | DC Fundamentals | 3 | 15 |
| EE3104 | Installation Fundamentals | 3 | 15 |
| EE3105 | Electrical Applications | 3 | 15 |
| EE3107 | Electricity Systems | 3 | 15 |
| EE3108 | Electricity Supply and Distribution | 3 | 15 |
| EE3109 | Circuit Design and Operation | 3 | 15 |
| EE3110 | Electrical Machines | 3 | 15 |

The content topics are listed for each course in the aims of these courses overleaf.

These topic headings are expanded into the curriculum details which are not listed in this document.

The course will not be delivered as a set of sequential courses but rather a logical delivery of progressive theory knowledge underpinned by demonstration, practical experience and hands on experimentation in an order that maximises understanding.

You will be continually assessed from the evaluation of your theory assignments, completion of your work books and evaluation of your practical tasks. In addition there will be a capstone unit standard assessment written by skills NZ which must be passed. The pass mark for the capstone assessment is set at 60%. This assessment is based on a selection of any course work that has been taught throughout the year.

A first aid and CPR course is required to be completed.

A site safe passport course is also offered as part of this course.

This course has been approved by Skills NZ and is able to be cross credited to their unit standards apprenticeship program on successful completion of the course.

**Aim of EE3102**

To acquire fundamental operational and theoretical knowledge of electrical work practices.

**Indicative Content:**

- First Aid and CPR in the work place
- Electrical Health & Safety practices and procedures
- Employment rights
- Literacy and Numeracy
- Communication skills – with stakeholders, managers, clients, peers, etc.
- Hazard identification
- Introduction to legislation, standards, and codes of practice governing electrical workers
- Introduction to testing
- Professional work practices and standards
- Regulations for supervision and apprentices
- Self-development, ethics and professionalism

**Learning outcomes**

By the end of this course the student will be able to:

1. Apply knowledge of electrical workplace health and safety.
2. Demonstrate knowledge of legislation governing electrical workplace health and safety and employment rights and responsibilities.
3. Apply knowledge of safe plant isolation and associated electrical testing procedures.
4. Achieve/Maintain a basic first aid and CPR certificate.

**Aim of EE3103**

To introduce fundamental knowledge and principles of Direct Current (DC) electrical installation practices.

**Indicative Content**

- Batteries
- Conductors, semi-conductors, and insulators
- DC switching and componentry
- Electronics
- Fault diagnosis and repair
- Fundamental theories of electromagnetism
- Levers, pulleys and gears
- Mathematics for electrical problems
- Ohms law
- Resistance in circuits and types of resistors
- Testing

**Learning outcomes**

By the end of this course the student will be able to:

1. Apply knowledge of conductors, insulators, and resistance in electrical circuits.
2. Apply electromagnetic theory to a range of problems.
3. Explain battery care and maintenance.

**Aim of EE3104**

To introduce fundamental knowledge and principles of electrical installation practices and associated legislation and standards.

**Indicative Content**

- Basic circuit installation and switchboard layouts
- Basic concepts of AC single phase
- Basic testing of installations and appliances
- Cable identification, characteristics, applications, installation and terminations
- Electrical protection
- Fault diagnosis and repair
- Introduction to three phase systems.
- Legislation, certification and supervision
- RCD's, isolating transformers and circuit breakers
- Relevant legislation and standards
- Single-phase alternating current
- Testing
- Generation, incl. prime movers
- Switchboards

**Learning outcomes:**

By the end of this course the student will be able to:

1. Demonstrate knowledge of a.c, cables and cords and their installation, and associated testing practices.
2. Demonstrate knowledge of electrical protection.
3. Under supervision perform testing of electrical installations.

**Aim of EE3105**

To understand and apply fundamental knowledge of electrical theory and practice to the installation and maintenance of electrical systems and equipment.

**Indicative Content**

- Electrical fittings and fixtures
- Hazardous materials & safety protocols
- High Voltage Knowledge, smart meters, earthing and bonding
- Special Electrical situations
- Lighting sources, relationships and lamp types Transformers construction and operating principles

**Learning outcomes**

By the end of this course the student will be able to:

1. Apply knowledge of electrical fittings and fixtures and their installation in line with specifications.
2. Apply knowledge of electric lighting, lighting terms, lighting installation, and safe disposal requirements.
3. Apply knowledge of single-phase transformer construction, operating principles, safety requirements, and applications.

**Aim of EE3107**

To extend knowledge of electrical systems and applications of direct and alternating current.

**Indicative Content**

- Capacitor and inductor types, Ratings, Applications, component markings, colour codes
- Diodes and rectification, DIAC, TRIAC, LED, Freewheeling diode, DC power supplies and other arc suppression methods
- Electromagnetic production of e.m.f
- Generator construction – relationship between the number of poles to the speed
- Ohm's law in a.c. calculations, impedance, capacitance, inductance, resonance/harmonics
- Power calculations – real power, apparent power, reactive power
- Reactive circuits, Resistive circuits, Time constraints
- Safety

**Learning outcomes**

By the end of this course the student will be able to:

1. Apply knowledge of inductance, capacitance, power factor, and power factor calculations.
2. Apply knowledge of electronics.

Apply knowledge of generator construction, operation, and single-phase theory

**Aim of EE3108**

To gain understanding of the fundamentals of the New Zealand electricity supply system and devices used to ensure the safety and protection of users and installations.

**Indicative Content:**

- Electrical protection for people and property
- Electricity generation, transmission and distribution in New Zealand
- Line and phase voltages
- Mains fuse protection
- Multiple electricity supply
- Power factors
- Safety protocols for electricity applications
- Special electrical installations
- Temporary supply
- Three-phase alternating current Transformers

**Learning outcomes**

By the end of this course the student will be able to:

1. Describe electricity generation, transmission, distribution, and electrical protection as applied in New Zealand.
2. Describe construction and operation of transformers used in the supply and distribution of electricity.
3. Demonstrate knowledge of special installations.

**Aim EE3109**

To understand the theory and application of electrical diagrams in terms of circuit design and lighting installations.

**Indicative Content**

- Circuit design and operation
- Circuit protection and control in circuit design
- Computer aided drawing tools
- Documentation for electrical diagrams
- Drawing schematics
- Economic evaluation of lighting
- Fault repair and diagnosis
- Lighting systems

**Learning outcomes**

By the end of this course the student will be able to:

1. Apply knowledge of electrical drawings and diagrams.
2. Apply knowledge of circuit protection and control in terms of circuit design.
3. Apply knowledge of lighting terminology, operation, and economic lighting systems and installation.

**Aim EE3110**

To acquire fundamental operational and theoretical knowledge of electrical work practices.

**Indicative Content**

- Electrical protection
- Environmental, mechanical and electrical hazards
- Fault diagnosis and repair
- Rotating electrical machines
- Special power supplies
- Single phase motors and alternators
- Testing – thermal imaging equipment

**Learning outcomes**

By the end of this course the student will be able to:

1. Apply knowledge of electric protection and fault diagnosis and repair
2. Demonstrate knowledge of special power supplies.
3. Apply knowledge to single-phase and three-phase alternators and motors.