Contents

Core information about Unit

UEENEEH114A - Troubleshoot resonance circuits...

This unit covers determining correct operation of resonance circuits used in electronic apparatus. It encompasses working safely, problem solving procedures, including the use of voltage, current and resistance measuring devices, providing solutions derived from measurements and calculations to predictable problems in resonance circuits.

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.
UEENEEEIOIA
Apply Occupational Health and Safety regulations, codes and practices in the workplace
AND
UEENEEEIO4A
Solve problems in d.c. circuits

The following is an extract from Training.gov.au accessed September 2014.

Evidence shall show an understanding of resonance circuit troubleshooting, applying safe working practices and relevant Standards, Codes and Regulations to an extent indicated by the following aspects:

T1. Basic engineering mathematics

SI Units
Using a calculator.
Basic Algebra
Applying the laws of indices.
Simplification of expressions involving square roots.
Graphs and tables.
Pythagoras' Theorem and trigonometry ratios.

T2. Sinusoidal alternating voltage and current

Generating a sinusoidal waveform
Definition of the terms period, peak, peak-to-peak, instantaneous, average, and root-mean-square value
Calculating the instantaneous value of a sinusoidal waveform
Calculating the root-mean-square value and frequency of a of a sinusoidal waveform
Phase relationship between two or more sinusoidal waveforms
Common waveforms used in electronic circuitry

Observation of sinusoidal and other waveforms

T3. A.C. measuring equipment

Operating principles of a cathode ray oscilloscope (CRO)
Set up, calibration and use of a CRO
Calibration and limitation of CRO probes
Analogue and digital a.c. measuring instruments including true root-mean-square reading instruments
Measurement of the instantaneous, peak, peak-to-peak values and period of sinusoidal and other common waveforms

T4. Phase relationships in a.c. circuits

Phasor representation of sinusoidal waveforms
Definitions of in-phase, out-phase, phase angle, lead and lag
Phasor addition of two voltages or currents

T5. Resistive a.c. circuits

Ohms law in a.c resistive circuits
Current and voltage phase relationship
Power dissipation

T6. Inductance in a.c. circuits

Principles of inductance
Units
Inductive time constant circuits
Inductive reactance
Ohms law in inductive a.c. circuits
Phase relationships
Verification of operation of RC time constant circuit

T7. Capacitance in a.c. circuits

Capacitive reactance
Ohms law in capacitive a.c. circuits
Current and voltage phase relationships

T8. Series a.c. circuits

Definition of Impedance
Impedance
The impedance triangle
Voltages distribution
Vector representation of current and voltages
Verification of operation of series a.c. circuit

T9. Parallel a.c. circuits

Current distribution
Vector representation of voltage and currents
Impedance calculations based on total circuit current and voltage
Verification of operation of parallel a.c. circuit

T10. Series-parallel a.c. circuits

Examples of circuit
Rules for simplification

T11. Power factor
Power triangle
True power
Apparent power
Reactive power
Power factor
Power factor correction

T12. Ideal transformer

Construction and operating principles
Step-up, step-down, turns ratios, voltage and current ratios
Autotransformer
Core losses
Types of cores and applications
Volt-Ampere (VA) rating
Verification of operation of transformer circuit

T13. Series resonance

Conditions in a circuit that produce series resonance
Relationship between resonance and frequency
Impedance of a series resonant circuit
Phasor representation of current and series voltage drops in series resonant circuit
Voltage magnification
The Q of a coil and its relevance
Bandwidth and half power points in a resonant circuit
Selectivity
Verification of operation of series resonant circuit

T14. Parallel resonance

Conditions in a circuit that produce parallel resonance
Impedance of a parallel resonant circuit
Vector representation of voltage and parallel branch currents in a parallel resonant circuit
Current magnification
Verification of operation of parallel resonant circuit

T15. Filters

Purpose of a filter
Circuits for operation of the following passive filter circuits: high pass, low pass, band stop and band pass
Bandwidth, attenuation, cut-off, roll off and order of filter
Measurements and calculations relating to passive filters
Curves showing the behaviour of various types of filter circuits
Verification of operation of each filter type

UEENEEG102A Solve problems in low voltage AC circuits

- A similar unit, but comprising single phase and 3 phase power in addition to the AC basics. Does not include transformers or Filters (band pass, band stop, low pass, high pass) or Resonance as applied to a tank circuit in electronics.
- T1 to T8 are effectively the same as the H114A unit. T9 to T15 are different.
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- Evidence shall show an understanding of alternating currents power circuits to an extent indicated by the following aspects:

T1 Alternating Current Quantities encompassing:

sine, cosine and tangent ratios of a right angle triangle
Pythagoras Theorem to a right angle triangle.
use of the CRO to measure d.c. and a.c. voltage levels
sinusoidal voltage generated by a single turn coil rotated in a uniform magnetic fields
terms 'period', 'maximum value', 'peak-to-peak value', 'instantaneous value', 'average value', 'root-mean-square (r.m.s.) value', in relation to a sinusoidal waveform.
calculation of the instantaneous value of induced voltage of a generated sinusoidal waveform.
measurement of instantaneous, peak, peak-to-peak values and the period of a sinusoidal waveform.
calculation of root-mean-square (r.m.s.) value and frequency of a sinusoidal waveform from values of peak voltage and period.

T2 Phasors Diagrams encompassing:

purpose of phasor diagrams
'in-phase', 'out-of-phase', 'phase angle'' lead' and 'lag'.
phase angle between two or more alternating quantities from a given sinusoidal waveform diagram.
convention for representing voltage, current and the reference quantity in a phasor diagram.
drawing phasor diagrams to show the relationship between two or more a.c. values of voltage and/or current.
determination of phase relationship between two or more sinusoidal waveforms from a given diagram and measurements.

T3 Single Element a.c. circuits encompassing:

setting up and connect a single-source resistive a.c. circuit and take voltage and current measurements to determine the resistance
determining the voltage, current resistances from measure of given values of any tow of these qualities.
relationship between voltage drops and current in resistive a.c. circuit
applications of resistive a.c. circuits
defining 'inductive reactance'.
calculation of inductive reactance for a given inductor and the relationship between inductive reactance and frequency.
applying Ohm's Law to determine voltage, current of inductive reactance in a purely inductive a.c. circuit given any two to these quantities.
applications of inductive a.c circuits.
calculation of capacitive reactance
applying Ohm's Law to determine voltage, current or capacitive reactance in a purely capacitive a.c circuit given any two of the quantities.
applications of capacitive a.c circuits

T4 RC and RL Series a.c. circuits encompassing:

impedance and impedance triangle.
determining the impedance, current and voltages for a series RC circuit given the resistance, capacitance and supply voltage.
drawing and labelling the impedance triangle for a series RC circuit
drawing phasor diagrams for a series RC circuit
AS/NZS 3000 requirements for the installation of capacitors.
examples of capacitive components in power circuits and systems and the effect on the phase relationship between voltage and current.
determining the impedance, current and voltages for a series RL circuit given the resistance, inductance and supply voltage.
drawing and labelling the impedance triangle for a series RL circuit
drawing the equivalent circuit of a practical inductor
Draw phasor diagrams for a series RL circuit.
examples of inductive components in power circuits and systems and describe their effect on the phase relationship between voltage and current

T5 RLC Series a.c. circuits encompassing:

measuring component voltages in a series RLC circuit and using a phasor diagram to determine the supply voltage and phase angle between circuit voltage and circuit current.
determining the impedance, current and voltages for a series RLC circuit given resistance, inductance, capacitance and supply voltage.
drawing and labelling the impedance triangle for a series RLC circuit.
calculation of total impedance for a series RLC circuit.
calculation of voltage drop for cables using the values for reactance and a.c. resistance from AS/NZS 3008.
comparison of current limiting characteristics of inductors and resistors.
practical examples of RLC series circuits

T6 Parallel a.c. Circuits encompassing:

determining the branch currents of a parallel circuit that contain RL, RC or LC in two branches.
using a phasor diagram to determine the total circuit current and phase angle in parallel RL, RC or LC circuits.
determining the total circuit impedance of parallel RL, RC or LC circuits.
measuring the branch currents in a parallel RLC circuit and use a phasor diagram to determine the total current and phase angle between circuit voltage and circuit current.
determining the branch impedances, branch currents and phase angles voltages for a parallel RLC circuit given resistance, inductance, capacitance and supply voltage.
calculation of impedance for a parallel RLC circuit.
practical examples of parallel circuits.

T7 Power in an a.c. circuit encompassing:

difference between true power, apparent power and reactive power and the units in which these quantities are measured.
drawing the power triangle to show the relationships between true power, apparent power and reactive power
defining the term "power factor" and phase angle.
methods used to measure single phase power, energy and demand.

T8 Power Factor Improvement encompassing:

effects of low power factor.

requirements for power factor improvement.
methods used to improve low power factor of an installation.
local supply authority and AS/NZS 3000 wiring rules requirements regarding the power factor of an installation and power factor improvement equipment.
methods used to measure single phase power factor.
using manufacturers catalogues to select power factor equipment for a particular installation

T9 Harmonics and Resonance Effect in a.c. Systems encompassing:

term "harmonic" in relation to the sinusoidal waveform of an a.c. power system.
sources in a.c. systems that produce harmonics.
problems that may arise in a.c. circuits as a result of harmonics and how these are overcome.
methods and test equipment used to test for harmonics
methods used to reduce harmonics in a.c. power system
conditions in a series a.c. circuit that produce resonance.
dangers of series resonance circuits
conditions in a parallel a.c. circuit that produce resonance.
dangers of parallel resonance circuits
AS/NZS3000 and the local supply authority requirements concerning harmonics and resonance effect in a.c. power systems.

T10 Three Phase Systems encompassing:

features of a multiphase system.
comparison of voltages generated by single and multiphase alternators.
reasons for the adoption of three phases for power systems.
how three phases is generated in a single alternator.
Calculation of r.m.s. value of voltage generated in each phase given the maximum value.
relationship between the phase voltages generated in a three phase alternator and the conventions for identifying each.
term "phase sequence" (also, referred to as "phase rotation").
determining the phase sequence of a three phase supply

T11 Three phase star-connections encompassing:

connecting a three phase star-connection load.
phase relationship between line and phase voltages and line and phase currents of a star-connected system.
determining the r.m.s. value of line and phase voltage given any one of these quantities.
determining the r.m.s. value of line and phase current given any one of these quantities.
terms "balanced load" and "unbalanced load".
effect of a reversed phase winding of a star connected alternator.
example of balanced and unbalanced loads in typical power systems.

T12 Three phase four wire systems encompassing:

purpose of the neutral conductor in a three phase four wire systems.
determining the effects of an high impedance in the neutral conductor of a three phase four wire system supplying an unbalanced load where MEN earthing is employed.
determining the value and phase relationship of neutral current in an unbalanced three phase four wire systems given line currents and power factors.
AS/NZS 3000 requirements regarding neutral conductors.
AS/NZS 3008.1.1 method for determining voltage drop in unbalanced three phase circuits

T13 Three phase delta-connections and Interconnected systems encompassing:

connecting three phase delta loads.
phase relationship between line and phase voltages and line and phase currents of a delta-connected system.
determining the r.m.s. value of line and phase voltage given any one of these quantities.
determining the r.m.s. value of line and phase current given any one of these quantities.
limitations and uses of open delta connections
effect of a reversed phase winding of a delta connected transformer
example of loads in typical power systems.
drawing the typical combinations of three phase interconnected systems using star-connections and a delta-connection.
relationship between line and phase voltages and line and phase currents in the typical interconnected systems using star-connections and delta-connections.

T14 Energy and power requirements of a.c. systems encompassing:

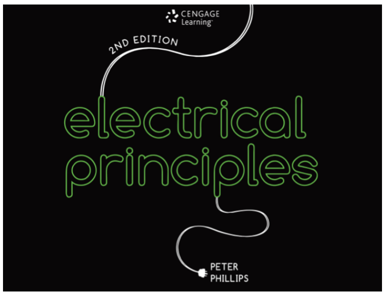
purposes for measuring power, energy, power factor and maximum demand of a.c. power systems and loads.
difference between true power, apparent power and reactive power and the units in which these quantities are measured in a three phase system.
drawing the power triangle to show the relationships between true power, apparent power and reactive power in a three phase system.
methods used to measure three phase power , energy, power factor and demand.
determining how the power factor of a three phase installation can be improved.
using manufacturers catalogues to select measurement equipment for a particular installation

T15 Fault Loop Impedance encompassing:

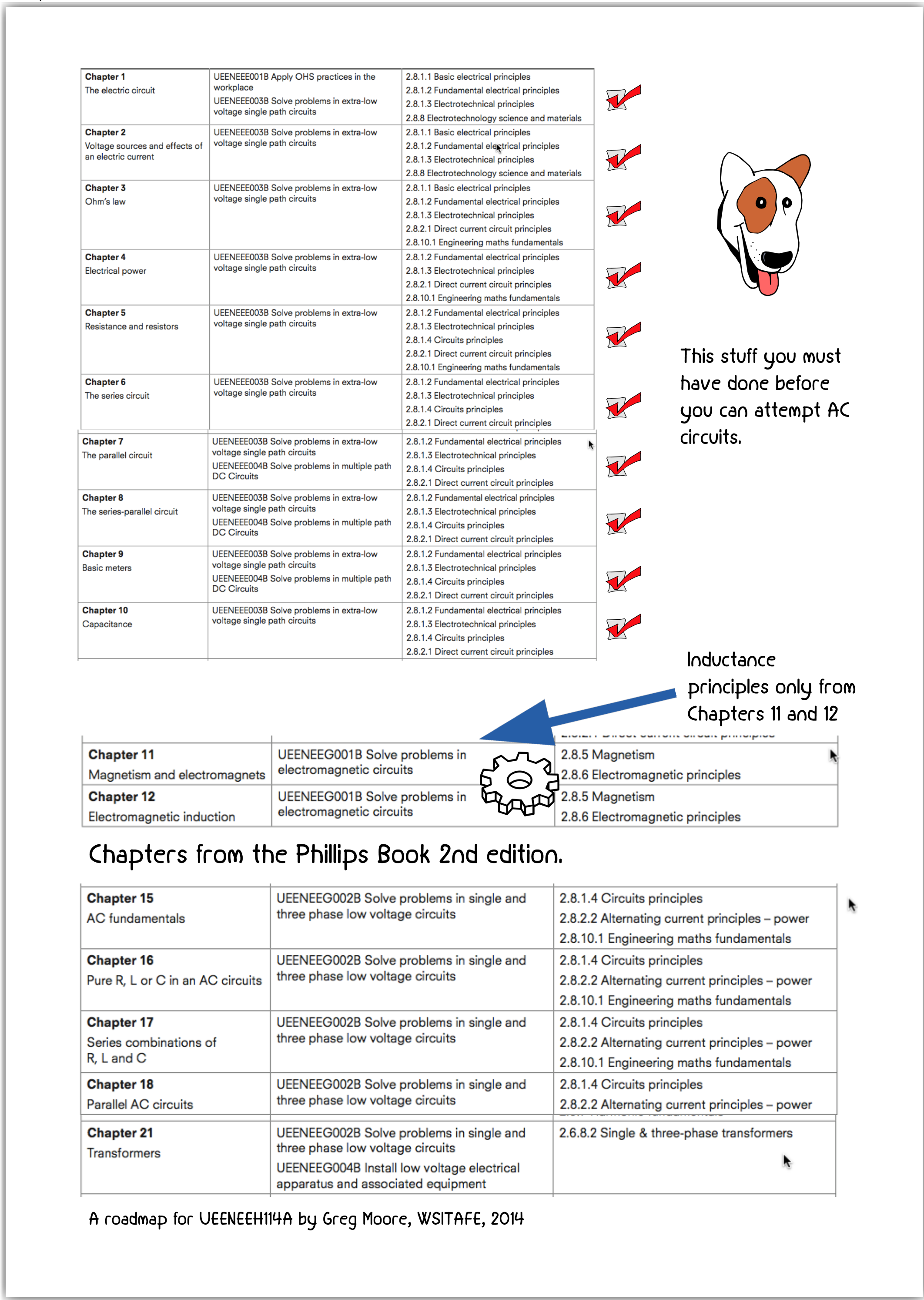
term fault loop impedance of a a.c. power system
determining fault loop impedance using resistance and reactance values from AS/NZS 3008.1.1
measuring fault loop impedance of typical circuits
procedures for testing fault loop impedance

TextBook

- Electrical Principles by Peter Phillips, second edition



- See my other notes in contents about the unit UEENEEG102A(002B). Another trades unit with some similarities to H114A



Chapter 1 The electric circuit	UEENEEE001B Apply OHS practices in the workplace UEENEEE003B Solve problems in extra-low voltage single path circuits	2.8.1.1 Basic electrical principles 2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.8 Electrotechnology science and materials
Chapter 2 Voltage sources and effects of an electric current	UEENEEE003B Solve problems in extra-low voltage single path circuits	2.8.1.1 Basic electrical principles 2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.8 Electrotechnology science and materials
Chapter 3 Ohm's law	UEENEEE003B Solve problems in extra-low voltage single path circuits	2.8.1.1 Basic electrical principles 2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.2.1 Direct current circuit principles 2.8.10.1 Engineering maths fundamentals
Chapter 4 Electrical power	UEENEEE003B Solve problems in extra-low voltage single path circuits	2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.2.1 Direct current circuit principles 2.8.10.1 Engineering maths fundamentals
Chapter 5 Resistance and resistors	UEENEEE003B Solve problems in extra-low voltage single path circuits	2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.1.4 Circuits principles 2.8.2.1 Direct current circuit principles 2.8.10.1 Engineering maths fundamentals
Chapter 6 The series circuit	UEENEEE003B Solve problems in extra-low voltage single path circuits	2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.1.4 Circuits principles 2.8.2.1 Direct current circuit principles
Chapter 7 The parallel circuit	UEENEEE003B Solve problems in extra-low voltage single path circuits UEENEEE004B Solve problems in multiple path DC Circuits	2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.1.4 Circuits principles 2.8.2.1 Direct current circuit principles
Chapter 8 The series-parallel circuit	UEENEEE003B Solve problems in extra-low voltage single path circuits UEENEEE004B Solve problems in multiple path DC Circuits	2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.1.4 Circuits principles 2.8.2.1 Direct current circuit principles
Chapter 9 Basic meters	UEENEEE003B Solve problems in extra-low voltage single path circuits UEENEEE004B Solve problems in multiple path DC Circuits	2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.1.4 Circuits principles 2.8.2.1 Direct current circuit principles
Chapter 10 Capacitance	UEENEEE003B Solve problems in extra-low voltage single path circuits	2.8.1.2 Fundamental electrical principles 2.8.1.3 Electrotechnical principles 2.8.1.4 Circuits principles 2.8.2.1 Direct current circuit principles

This stuff you must have done before you can attempt AC circuits.

Inductance principles only from Chapters 11 and 12

Chapter 11 Magnetism and electromagnets	UEENEEG001B Solve problems in electromagnetic circuits	2.8.5 Magnetism 2.8.6 Electromagnetic principles
Chapter 12 Electromagnetic induction	UEENEEG001B Solve problems in electromagnetic circuits	2.8.5 Magnetism 2.8.6 Electromagnetic principles

Chapters from the Phillips Book 2nd edition.

Chapter 15 AC fundamentals	UEENEEG002B Solve problems in single and three phase low voltage circuits	2.8.1.4 Circuits principles 2.8.2.2 Alternating current principles – power 2.8.10.1 Engineering maths fundamentals
Chapter 16 Pure R, L or C in an AC circuits	UEENEEG002B Solve problems in single and three phase low voltage circuits	2.8.1.4 Circuits principles 2.8.2.2 Alternating current principles – power 2.8.10.1 Engineering maths fundamentals
Chapter 17 Series combinations of R, L and C	UEENEEG002B Solve problems in single and three phase low voltage circuits	2.8.1.4 Circuits principles 2.8.2.2 Alternating current principles – power 2.8.10.1 Engineering maths fundamentals
Chapter 18 Parallel AC circuits	UEENEEG002B Solve problems in single and three phase low voltage circuits	2.8.1.4 Circuits principles 2.8.2.2 Alternating current principles – power
Chapter 21 Transformers	UEENEEG002B Solve problems in single and three phase low voltage circuits UEENEEG004B Install low voltage electrical apparatus and associated equipment	2.6.8.2 Single & three-phase transformers

A roadmap for UEENEEH114A by Greg Moore, WSITAFE, 2014

AC circuits phillips map page.spub.pdf

Topics and material

Week 1

Rough outline, draft plan
discuss unit and discuss equipment to be learned and used.
textbook discussion and what you should have completed and be competent in before you can attempt this unit.
mathematics and trigonometry lesson
the AC waveform and parameters, introduce phase difference between two sinewaves.
using the oscilloscope for DC and AC coupling - lab
AC superimposed with DC
Review capacitors and introduce inductors.
preview RC and RL circuit and use with CRO to find phase angle - lab

Week by week program of delivery (in planning) and fact that week 2 (immediately following holidays) is a public holiday, so homework assignment to be set and given.
Stress that this unit is difficult.
Week by week quizzes and homework. Homework to be checked on arrival.

SAG to be finalised by week 3 and handed out then.