

MODULE TITLE	POWER SYSTEMS ANALYSIS
Nominal Duration	One Module
Module Code or Number	EA 140
Module Purpose	To enable students, under the direction of a technician, to connect single and three phase loads to a three phase power frequency supply; by calculation to predict line currents, power, and power factor, and to confirm them by measurement.
Relationship to Competency Standards	<p>This module will be modified in line with the requirements of the National Metals and Engineering Standards when they become available.</p> <p>The module contains the knowledge and skills identified and agreed by all states/territories. It has been developed on the assumption that these will be reflected in the standards.</p>
Prerequisites	NE 09 Single and Three Phase Circuits
Summary of Content	<ol style="list-style-type: none"><u>Impedance of Three-Phase Load</u><ul style="list-style-type: none">Complex analysisImpedanceTypical three-phase loads, ie induction motors, transformers, heating loadsThe impedance of three phase loadsMeasurement of impedanceConversion of impedance between star and delta

2. Analysis of Mixed Load Three-Phase Circuits

Three-phase supply

Star and Delta systems

Mixed single and three-phase loads

Balanced and unbalanced loads

Representation of voltage and current
as phasers in the frequency domain

Calculation of line and phase currents
in both star and delta loads

Total line currents for mixed loads

Determination of power in three-phase
systems, including the use of current
transformers

Power factor

Prediction of currents and voltage on
the loss of the neutral

Computer simulation

3. Measurement in Three-Phase Circuits

Measurement of voltage, current, power
and power factor in mixed circuits

Types of instruments

Safety procedures

Sources of error

Systematic recording and reporting of
experimental data

Comparison of predicted with
experimentally derived data

Reasons for disparity

4. Line Voltage Drops

Cable losses

Voltage drop and its effect

Heat dissipation

Australian Standards and limitation of losses

Methods to minimise line losses

5. Power Factor Correction

Requirement for correction

Determination of the size of reactive element to effect the required improvement

Qualitatively deal with synchronous machines as a means of correction

Connect a power factor correcting device in circuit, measure the new line parameters, and compare with predicted

Delivery

Learning outcomes

On completion of this module the learner will be able to:

Learning Outcome 1

Determine the impedance of common three phase loads by appropriate measurement.

Assessment criteria

Through assignment and given appropriate data, perform calculations using complex analysis to calculate impedance.

In a laboratory environment, perform tests necessary to determine the impedance of single and three phase loads, and demonstrate the correct procedures for safe work practices.

Examine the theoretical understanding of complex mathematics, and the calculation of impedance.

Conditions

Assessment method Assignment, practical test and theory test

Learning Outcome 2

Predict the line and phase currents, voltage, power and power factor for a mixed connection of single and three phase loads.

Assessment criteria

Through assignment, and given the data for mixed single and three phase loads, perform calculations using complex analysis in the frequency domain to determine specified voltages, currents, power factors, and power.

In the laboratory with access to loads and a three phase supply, connect loads as specified, and measure required voltages, currents, power factors, and power using appropriate safe working practice.

Conditions

Assessment method

Assignment, practical test and theory test

Learning Outcome 3

Confirm the predicted values by measurement.

Assessment criteria

With access to a three-phase supply and a nominated load, select the appropriate instrument for the specified task. Correctly connect the instruments and perform the measurements demonstrating safe working practice. The tasks must be performed in a manner that demonstrates correct handling of instruments, and correct methods of termination.

Conditions

Assessment method

Practical test

Learning Outcome 4

Calculate line voltage drops.

Assessment criteria

Given all necessary data, and through assignment, to calculate line losses for specified problems that have industrial application.

A one hour theory test . Given the data for a realistic problem, students to apply the SAA wiring rules and confirm that the line losses are within specification.

Conditions

Assessment method

Assignment and theory test

Learning Outcome 5

Select the means of correcting power factor of a three phase load, predict the outcome by calculation, and confirm by measurement.

Assessment criteria

With access to a three-phase load, measure the power factor and calculate the size of correction required. Connect and test, using safe work practices, and demonstrating correct procedures for handling instruments.

Conditions

Assessment method

Practical Test

Suggested Learning Resources

Physical resources

Texts/references