

Advanced Diploma of Applied Electrical Engineering

(DEE – 52883WA)

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| **Student full name:** | Ryan Anthony Wilkins |
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| Please place a tick (☑) in the box below to indicate that you have read, understood, and certify the above statement.  Please include this page in/with your submission.  Any electronic responses to this submission will be sent to your Moodle account.  **AGREEMENT**     ✓image2.pdf  **DATE:** 01/09/2025 | |

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| --- | --- | --- | --- |
| Marks (%) |  | Satisfactory / Not Satisfactory | |
| Assessor: |  | Date: |  |
| Overall feedback: |  | | |

Guidelines for Students

**How is this module assessed?**

After completion of this assessment, you will be given a result of ‘Satisfactory’ or ‘Not Satisfactory’. The assessor will give you feedback via Moodle and you will have an opportunity to submit additional evidence, if you have received a ‘Not Satisfactory’ result.

You will be allowed one (1) opportunity to resubmit the same assessment task, if required.

For a ‘Satisfactory’ result in this assessment, all questions must be answered to a satisfactory standard and you must achieve an overall mark of 60% or above.

Once all assessment tasks for this module have been completed, you will be given a final module result of ‘Competent’ or ‘Not Yet Competent’. If you are deemed ‘Not Yet Competent’ in a module after all resubmission attempts, you will be required to re-sit the module.

**How is this assessment task assessed?**

For a result of ‘Satisfactory’ in this assessment task, all module assessment criteria (as indicated on page 4) must be completed to a satisfactory standard.

Where a **critical question** is identified, you must receive a mark of 100% for these questions before a ‘satisfactory’ result can be awarded, regardless of the overall mark achieved.

At Advanced Diploma level, a ‘satisfactory’ standard, as stipulated by the Australian Qualifications Framework, means that you will demonstrate the application of knowledge and skills:

* with depth in areas of specialisation, in contexts subject to change
* with initiative and judgment in planning, design, technical or management functions with some direction
* to adapt a range of fundamental principles and complex techniques to known and unknown situations
* across a broad range of technical or management functions with accountability for personal outputs
* personal and team outcomes within broad parameters

Assessors also make decisions based on the following considerations:

* all parts of this assessment have been completed to a standard that satisfactorily meets the requirements set out in the assessment criteria (as per the module outline).
* the assessment evidence provided is the student’s own work, except as appropriately acknowledged by the use of referencing.
* the evidence is recent and the student’s knowledge is up-to-date

**Assessment Instructions:**

1. You **must** answer ALL questions.
2. Please ensure you complete your answers in a **blue** font (not red or black).
3. The best marks can be earned by giving concise, brief answers that address the questions.
4. You must reference all content used from other sources including course materials, slides, diagrams, etc. Do not directly copy and paste from course materials or any other resources.   
   Refer to the referencing section of the EIT eLibrary on Moodle for referencing guides.
5. Work submitted may be subjected to a plagiarism detection process. If this process is used, then copies of this work would be retained and used as source material for conducting future plagiarism checks.
6. Use this document for completing your answers by typing the answers after each question without deleting the question. Make sure that you preserve the original question number format.
7. Do not add extra pictures, etc. as annexures; instead, paste them directly into this answer sheet. Hand-drawn sketches can be inserted after scanning but please ensure that the file size does not become big (more than 10 MB). You must refer to all diagrams and pictures, etc. that you have drawn or pasted in.
8. When saving your document (must be Word format), ensure you include your name in the title: COURSECODE\_MODULE#\_ASSESSMENTTYPE\_VERSION#\_YOURNAME

**E.g. DEE\_DETTM613\_WrittenAssessmentB\_v1\_JohnSmith**

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| --- | --- |
| **Module no. and name:** | **DEETTM613: Testing, Troubleshooting and Maintenance of Electrical Equipment** |
| **Assessment type:** | **Written Assessment Paper B** |
| **Total marks:** | **80** |

**Learning outcomes covered in this assessment:**

LO1: Outline the fundamentals of testing and testing equipment.

1.1 Explain the steps required for troubleshooting and testing

1.2 Explain with examples testing equipment, their application and operation

1.3 Develop a plan for forming a testing group in a large industrial plant.

LO2: Explain the various types of testing methods.

2.1 Explain the procedure and purpose of the following types of testing:

(a) high potential tests,

(b) oil testing,

(c) TAN Delta testing,

(d) partial discharge testing,

(e) impulse testing"

2.2 Explain the role of measurement of low resistance in electrical testing

LO3: Outline electrical equipment testing and maintenance procedures.

3.1 Outline key procedures for troubleshooting and testing of transformers

3.2 Outline cable testing procedures during operation and fault detection

3.4 Explain procedures for troubleshooting and testing of HV equipment

3.5 Explain the organisational aspects of testing and maintenance of testing records

Submission requirements:

* Provide the required answers below in **blue font** (not red or black).
* This assessment MUST be submitted along with the Practical Assessment.
* All questions must be attempted. No score will be assigned if all questions are not attempted

**Part A: Descriptive Answers**

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| **Q1** | 1. What does the ‘Tanδ’ test measure in insulation testing? (1 mark) 2. Which two measurements are used as a ratio in this test? Provide the formula for Tanδ. (1 mark) 3. Is a high Tanδ value desirable? Justify our answer. (2 marks) | | **(4 marks)** |
| **A1** | **Student answer:**  a) Checks insulation quality by measuring dielectric loss.  b) Uses resistive current (Ir) and capacitive current (Ic):  Tanδ = Ir / Ic  C) High Tanδ is bad, it means insulation is leaking energy, possibly damaged or aged. Low is better | | |
| **F1** | **Assessor feedback:** | | **(marks awarded)** |
|  |  | | |
| **Q2** | List two common tests used for insulation testing in high-voltage equipment | **(4 marks)** | |
| **A2** | **Student answer:**  Insulation Resistance (IR) Test  Dielectric Dissipation Factor (Tanδ) Test | | |
| **F2** | **Assessor feedback:** | | **(marks awarded)** |
|  |  | | |
| **Q3** | 1. In your own words, explain the difference between Run-to-Failure (RCM) and Condition-Based Maintenance (CBM). (2 marks) 2. What are the advantages of CBM over RCM? (2 marks) | | **(4 marks)** |
| **A3** | **Student answer:**  a) Run-to-Failure lets equipment run until it breaks, then it gets fixed. Condition based maintenance checks equipment regularly and fixes it before it fails  b) CBM avoids surprise breakdowns, reduces downtime, and extends equipment life, unlike RCM which can lead to costly failures | | |
| **F3** | **Assessor feedback:** | | **(marks awarded)** |
|  |  | | |
| **Q4** | Identify two primary causes of insulation degradation in electrical equipment. | **(4 marks)** | |
| **A4** | **Student answer:**  Heat buildup  Moisture exposure | | |
| **F4** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q5** | 1. Name two tests conducted during the installation of cables. 2. Name two tests performed during maintenance of cables. 3. Which standard is applicable in Australia for XLPE insulated Aerial bundled cables? 4. What is considered a good reading for partial discharge in pC for a cable category ‘A’ at 50/60Hz. | | **(4 marks)** |
| **A5** | **Student answer:**  Installation tests:  a)Insulation Resistance Test  Continuity Test  b)Maintenance tests:  Tanδ Test  Partial Discharge Test  c)Applicable standard in Australia:  AS/NZS 3560 for XLPE insulated Aerial Bundled Cables  d)Good partial discharge reading (Category A):  Less than 5 pC at 50/60Hz | | |
| **F5** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q6** | Using diagrams, describe the four basic partial discharge test circuits according to IEC 60270. | | **(4 marks)** |
| **A6** | **Student answer:** | | |
| **F6** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q7** | In your own words, provide four examples of what to observe during the first stage of troubleshooting electrical equipment failure | | **(4 marks)** |
| **A7** | **Student answer:**  Check for any weird smells like burning  Look if there’s any damage or burn marks  Listen for strange noises or buzzing  See if lights or displays are off or flickering | | |
| **F7** | **Assessor feedback:** | | **(marks awarded)** |
|  |  | | |
| **Q8** | Outline the five-step process for troubleshooting electrical equipment. | **(4 marks)** | |
| **A8** | **Student answer:**  Find the problem  Gather info (what’s working, what’s not)  Test possible causes  Fix the issue  Run and check it works right | | |
| **F8** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q9** | List four potential causes of failure in a trip mechanism or trip coil within a circuit breaker | | **(4 marks)** |
| **A9** | **Student answer:**  Broken coil winding  Mechanical jamming  Loss of control power  Burnt or dirty contacts | | |
| **F9** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q10** | 1. In your own words, describe the three types of safety documentation commonly used in electrical work. (3 marks) 2. What is the minimum safe working distance from live conductors operating at up to 33 kV? (1 mark) | | **(4 marks)** |
| **A10** | **Student answer:**  a)Job safety analysis (JSA), breaks down tasks and points out hazards  Permit to work – gives written OK to do the job safely  Lockout/tagout sheet – tracks what’s shut off and locked for safety  b)Min safe distance for up to 33kV – 650 mm | | |
| **F10** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q11** | Test Planning and Reporting for Electrical Equipment  **Note**: Assume all tests follow IEC/ANSI standards unless specified.   1. List the four systematic phases for developing a test plan for high-voltage electrical equipment. 2. Why is the reporting phase critical when testing mission-critical electrical assets? 3. For a routine insulation resistance test on a 6.6kV motor, what two key elements must the final report include to be actionable for maintenance teams? 4. A technician is planning a Tanδ test on a 33kV cable. What factors determine the minimum test duration? Justify a test duration of 1 hour versus 4 hours. | | **(4 marks)** |
| **A11** | **Student answer:**  a)Four phases for developing a test plan:  Define objectives  Select test methods  Prepare procedures and equipment  Schedule and assign responsibilities  b)Why reporting is critical:  It gives clear proof of equipment condition, helps track trends, supports future decisions, and ensures accountability, especially important for assets that can’t fail  c)Key elements for 6.6kV motor IR test report:  Measured resistance value with test voltage  Ambient temp and test duration  d)Tanδ test duration factors:  Cable length, insulation type, and temperature stability affect how long you test.  1 hour may catch obvious issues. 4 hours helps spot slow-forming defects like moisture ingress or insulation breakdown over time. Longer test = more reliable results | | |
| **F11** | **Assessor feedback:** | | **(marks awarded)** |
|  |  | | |
| **Q12** | List four checks to undertake on alternators as part of the maintenance regime. | | **(4 marks)** |
| **A12** | **Student answer:**  Check insulation resistance  Inspect bearings for wear  Test output voltage and frequency  Look for signs of overheating or damage | | |
| **F12** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q13** | 1. Name two types of equipment that use oil for insulation. (2 marks) 2. List two key parameters that can be tested in oil that is used for insulation. (2 marks) | | **(4 marks)** |
| **A13** | **Student answer:**  a)Equipment:  Power transformers  Oil circuit breakers  b)Oil test parameters:  Dielectric strength  Moisture content | | |
| **F13** | **Assessor feedback:** | | **(marks awarded)** |
|  |  | | |
| **Q14** | Identify four scenarios where low-resistance measurements are essential in electrical testing. | | **(4 marks)** |
| **A14** | **Student answer:**  Testing circuit breaker contacts  Checking motor windings  Verifying bonding/grounding connections  Inspecting busbar and cable joints | | |
| **F14** | **Assessor feedback:** | | **(marks awarded)** |
|  |  | | |
| **Q15** | In your own words, compare the 2-Wire, 3-wire and 4-wire methods for resistance measurement, including their accuracy and typical applications. | **(4 marks)** | |
| **A15** | **Student answer:**  2-wire is simple but less accurate ‘cause lead resistance affects the reading. It’s fine for high resistance stuff like heaters.  3-wire is better for medium accuracy, often used in RTDs. It helps cancel out some lead error.  4-wire is the most accurate. It fully removes lead resistance effects, perfect for low-resistance testing like motor windings or grounding. | | |
| **F15** | **Assessor feedback:** | | **(marks awarded)** |
|  |  | | |
| **Q16** | 1. Why is Insulation Resistance (IR) testing important? (1 mark) 2. What instrument is used for IR testing? (1 mark) 3. Name an alternative testing method for gas-insulated systems. (1 mark) 4. Provide two examples of equipment that require regular IR testing. (1 mark) | **(4 marks)** | |
| **A16** | **Student answer:**  a)It checks insulation health and prevents failures.  b)Meggar (or insulation tester) is used.  c)Alternative: Very Low Frequency (VLF) testing.  d)Examples: Transformers and HV cables. | | |
| **F16** | **Assessor feedback:** | | **(marks awarded)** |

**Part B: Multiple Choice**

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| **Q17** | Which components of an alternator require the most frequent maintenance including un-pitted or cracked surfaces?   1. Brushes 2. Regulator 3. Slip rings 4. Bearings | **(2 marks)** |
| **A17** | **Student answer:**  Brushes and slip rings need the most frequent maintenance, especially checking for wear, pitting, or cracks, a and c | |
| **F17** | **Assessor feedback:** | **(marks awarded)** |
|  |  | |
| **Q18** | Which of the following is not a routine test for transformers?   1. Winding resistance measurement 2. Core magnetism measurement 3. No-load loss measurement 4. Insulation resistance test | **(2 marks)** |
| **A18** | **Student answer:**  b | |
| **F18** | **Assessor feedback:** | **(marks awarded)** |
|  |  | |
| **Q19** | Which standard does not apply to cable installations in Australia?   1. AS/NZS 3198 2. AS/NZS 1428 3. AS/NZS 3008 4. AS/NZS 3000 | **(2 marks)** |
| **A19** | **Student answer:**  b | |
| **F19** | **Assessor feedback:** | **(marks awarded)** |
|  |  | |
| **Q20** | True or False:  A hipot test evaluates the mechanical strength of insulation. | **(2 marks)** |
| **A20** | **Student answer:**  False | |
| **F20** | **Assessor feedback:** | **(marks awarded)** |
|  | | |
| **Q21** | Which gravity range indicates oil contamination?   1. 0.6 < x < 0.7 2. 0.7 < x < 0.8 3. 0.8 < x < 0.9 4. 0.9 < x < 1.0 | **(2 marks)** |
| **A21** | **Student answer:**  D | |
| **F21** | **Assessor feedback:** | **(marks awarded)** |
|  |  | |
| **Q22** | A 6.6/11kV transformer’s insulation resistance (IR) was tested at 40 degrees ambient temperature. Which IR value is considered safe?   1. 50 2. 150 3. 250 4. 10 | **(2 marks)** |
| **A22** | **Student answer:**  b | |
| **F22** | **Assessor feedback:** | **(marks awarded)** |
|  |  | |
| **Q23** | Which of the following is not part of the performance test phases?   1. Photographing Phase 2. Testing phase 3. Initial preparation phase 4. Reporting Phase | **(2 marks)** |
| **A23** | **Student answer:**  A | |
| **F23** | **Assessor feedback:** | **(marks awarded)** |
|  |  | |
| **Q24** | Which of the following is not caused by electrical faults?   1. Sparking 2. Induction 3. Partial Discharge 4. Arcing | **(2 marks)** |
| **A24** | **Student answer:**  b | |
| **F24** | **Assessor feedback:** | **(marks awarded)** |

**END OF ASSESSMENT**