

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:** 03/09/2025 | |

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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\_DEEESW612\_PracticalAssessment\_PaperB\_v1\_JohnSmith**

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| **Module no. and name:** | **DEEESW612: Electrical Safety and Wiring Regulations** |
| **Assessment type:** | **Practical Assessment Paper B** |
| **Version:** | **1** |
| **Total marks:** | **45 marks** |

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| **Q1** | A bird sitting on a transmission line or a live wire does not get shocked. Give reason in terms voltage, current and resistance.  Finally, what must change, in terms voltage, current and resistance to allow current to flow through the bird?  Picture 5**Picture 12** | | **(5 marks)** |
| **A1** | **Student answer:**  Why the bird doesn’t get shocked:  The bird sits on one wire only, so there’s no voltage difference across its body.  No voltage difference, no current flow  Since there’s no current, the bird is safe  What must change for the bird to get shocked:  There must be a voltage difference across its two feet like touching two wires or a wire and a grounded object.  Then, current would flow through the bird because now V doesnt equal 0, and I = V/R becomes non zero | | |
| **F1** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q2** | Use the table below and Ohm’s law to determine how much voltage would be necessary on a finger touch clean, dry-skin condition (use RBody=1MΩ) to produce a current of 20 milliamps (enough to cause unable to let go of the voltage source). Do the same calculation with a wet skin which will reduce the body resistance to a value of 15kΩ.  What will the voltage be under full contact with a large metal object such as a pipe or metal handle of a tool, with the body resistance dropping as low as 1,000 ohms (1kΩ)?  **Picture 18** | **(5 marks)** | |
| **A2** | **Student answer:**  Dry skin (1 M ohms): V = 0.02 A × 1,000,000 ohms = 20,000 V  Wet skin (15 ohms): V = 0.02 A × 15,000 ohms = 300 V  Full contact (1 ohms): V = 0.02 A × 1,000ohms = 20 V | | |
| **F2** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q3** | Unlike birds, who can perch on one wire without being electrocuted, the man working on the live high voltage lines below is in danger because he is touching two wires at the same time, why doesn’t he get shocked?  Picture 11 | | **(5 marks)** |
| **A3** | **Student answer:**  He doesnt get shocked because his body is at the same voltage as the wires. Before touching them, he is connected to the linethrough a special conductive suit or liveline tool that brings his body to the same potential. Since there’s no voltage difference, no current flows through him | | |
| **F3** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q4** | The best protection against shock from a live circuit is resistance and the current will only be limited by body resistance if a person is in direct contact with voltage source (as shown in figure and equation below). Resistance can be added to the body through the use of insulated tools, gloves, boots, and other gear. Current in a circuit is a function of available voltage divided by the total resistance in the path of the flow.  Picture 13  Draw an equivalent circuit and formula from Ohm’s law for a person wearing insulated gloves and boots. | **(5 marks)** | |
| **A4** | **Student answer:**  Equivalent Circuit Description:  Voltage source -> Glove resistance -> Body resistance—> Boot resistance—> back to voltage source  Ohm’s Law Formula (with protective gear):  I = V / (R\_gloves + R\_body + R\_boots)  Where:  I = current (in amperes)  V = voltage (in volts)  R\_gloves = resistance of insulated gloves  R\_body = resistance of the human body  R\_boots = resistance of insulated boots | | |
| **F4** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q5** | If we take a look at a simple, household electrical appliance such as a toaster with a conductive metal case, we can see that there should be no shock hazard when it is operating properly. The wires conducting power to the toaster’s heating elements are insulated from touching the metal case (and each other) by rubber or plastic.  Picture 15  If the “hot” or live wire accidentally comes in contact with the metal case, it places the user of the toaster in danger.  Picture 14   1. What will happen if the neutral wire accidentally comes in contact with the metal case? 2. How can appliances be designed to minimize hot/live conductor contact with the case? 3. How will this preventative measure be affected if the power plug polarity is reversed? | | **(5 marks)** |
| **A5** | Student answer:  a) If the neutral wire touches the metal case:  Nothing dangerous will happen because neutral is at or near ground potential, so no shock riskk  b) How to minimise hot/live conductor contact with the case:  Use double insulation, polarised plugs, and ground the metal case so current goes to earth, not the user  c) Effect if power plug polarity is reversed:  Now the hot wire might connect to the metal case instead of neutral, making it dangerous and defeating the safety design | | |
| **F5** | **Assessor feedback:** | | **(marks awarded)** |
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| **Q6** | The first step in conducting arc flash calculations is to estimate the arcing short circuit current. The magnitude of an arcing fault will be less than a bolted fault due to the arc impedance. The calculation is based on using the bolted three phase short circuit current obtained from a standard short circuit study. A short circuit study indicates the available “bolted” three-phase fault current at 380V Panel is 22,000 Amps. The power system is considered to be solidly grounded and the arc flash is in a box representative of an enclosure.  log Ia = k + 0.662log Ibf + 0.0966V + 0.000526G + 0.5588V(log Ibf) –  0.00304G (log Ibf)  Where: Ia = 10 log Ia and log = log10   * Ia = arcing current in kA * k = - 0.153 for open air and - 0.097 for arcs in a box * Ibf = bolted three-phase available short-circuit current (symmetrical rms kA) * V = system voltage in kV * G = conductor gap in millimeters (mm)   To determine the incident energy at the worker location:  log Ein = k1 + k2 + [1.081 x (log Ia)] + 0.0011G with Ein = 10 Log Ein  Ein is normalized for 0.2 s and 610 mm working distance (24 inches). To calculate Ei for specific condition:     * k1 = open air or in a box factor k2 = ground / ungrounded factor * k1 = - 0.792 for open air arcs and - 0.555 for the arc occurring in a box (represents a panel) * k2 = - 0.113 for a grounded system and 0 for ungrounded or hi Z * Cf = calculation factor X = distance exponent = 1.5 for voltages < 1 kV * t = arcing time in seconds from time current curves (use 0.083 seconds) * Dw = working distance (typically 18 inches commonly used for some low voltage distribution equipment, worker standing back from live bus)   Metric conversions:   * 1 Inch = 25.4 millimeters * 0.24 cal / cm2 = 1 Joule/cm2   Picture 25  Table 1 Factors for Equipment and Voltage Classes - From IEEE 1584-2002tm  The Arc Flash Boundary (AFB) known as Flash Hazard Boundary in IEEE 1584, is defined as an “approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur”. This boundary is typically calculated as the distance where the incident energy falls off to 1.2 cal /cm2.  To determine the Arc Flash Boundary:     * DB = distance from arc in mm * EB = incident energy at the arc flash boundary, typically 1.2 cal/cm2 or 5 Joules/cm2  1. Using the EEE 1584-2002tm Equation for estimating the Arcing Short Circuit Current above and Table 1 for typical conductor gap, calculate Arcing Short Circuit Current. Since lower fault currents can cause overcurrent devices to respond more slowly, a second calculation is also performed based on 85% of the estimated current to account for unknowns. The greater of the two incident energy calculations is used for the results. 2. Using the information above, calculate the Normalized Incident Energy Ein which is normalized for 0.2 s and 610 mm working distance (24 inches). 3. The value in b) needs to be adjusted to the actual working distance and clearing time by calculating the Adjusted Incident Energy or the Ei for specific condition. 4. Using the equation above, determine the Arc Flash Boundary DB using incident energy at the arc flash boundary of 5 Joules/cm2. 5. Verify result with the Arc Flash Calculator on webpage <https://myelectrical.com/tools/arc-flash-calculator>. | | **(15 marks)** |
| **A6** | **Student answer:**  1. Arcing Currrent Ia  log Ia = k + 0.662 x log Ibf + 0.0966 x V + 0.000526·G + 0.5588·V x log Ibf – 0.00304 xG·log Ibf  Ia = 10^(log Ia)  2. Normalised Energy Ein  log Ein = k1 + k2 + 1.081 xlog Ia + 0.0011·G  Ein = 10^(log Ein)  3. Actual Incident Energy Ei  Ei = 4.184 x Cf x Ein x (t / 0.2) · (610 / Dw)^x  Where:  k = -0.153 (open air) -0.097 (box)  k1 = -0.792 (air) -0.555 (box)  k2 = -0.113 (grounded), 0 (ungrounded)  x = 1.5 for less then 1kV  t = arcing time in sec  Dw = distance in mm  G = gap in mm  V = volts (kV)  Ibf = boltted fault current (kA) | | |
| **F6** | **Assessor feedback:** | | **(marks awarded)** |

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| **Q7** | What skills or knowledge did I gain from this assessment, and how can I apply these in future projects? | **(5 marks)** |
| **A7** | **Student answer:**  I learned how voltage, current, and resistance affect electric shock, how to read and modify circuits for safety, and how to calculate arc flash risks. I can use this in future projects to design safer systems and follow electrical safety rules | |
| **F7** | **Assessor feedback:** | **(marks awarded)** |

**END OF ASSESSMENT**