



# MEDI12002 *Science and Instrumentation 1*

## Term 1 - 2023

Profile information current as at 03/05/2024 08:29 am

All details in this unit profile for MEDI12002 have been officially approved by CQUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

## General Information

### Overview

This unit focuses on the main steps in producing a useful digital radiograph. You will learn to control the x-ray beam's production and passage through the structures by judicious selection of technical factors. You will learn to control scatter radiation and recognise its impact on radiographs. You will harness image geometry concepts to control structural appearances on radiographs. You will explore basic concepts of digital imaging technology with a focus on clinical skill in the production, display, manipulation, storage and distribution of digital radiographs. You will become familiar with the attributes of radiographic image quality and the many factors that impact on those attributes.

### Details

Career Level: *Undergraduate*

Unit Level: *Level 2*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

### Pre-requisites or Co-requisites

Pre-requisites: MEDI11001 Fundamentals of Imaging Professions MEDI11002 Physics for Health Sciences ESSC11004

Study and Research Skills for Health Sciences Co-requisite: MEDI12001 Radiation Science

Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the [Assessment Policy and Procedure \(Higher Education Coursework\)](#).

### Offerings For Term 1 - 2023

- Mackay

### Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

### Website

[This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.](#)

## Class and Assessment Overview

### Recommended Student Time Commitment

Each 6-credit Undergraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

### Class Timetable

#### [Regional Campuses](#)

Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

#### [Metropolitan Campuses](#)

Adelaide, Brisbane, Melbourne, Perth, Sydney

### Assessment Overview

#### 1. **Online Test**

Weighting: 40%

#### 2. **In-class Test(s)**

Weighting: 60%

### Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the [University's Grades and Results Policy](#) for more details of interim results and final grades.

## CQUniversity Policies

**All University policies are available on the [CQUniversity Policy site](#).**

You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the [CQUniversity Policy site](#).

## Previous Student Feedback

### Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

#### Feedback from SUTE

##### **Feedback**

Clarity of quizzes and expectations was identified by a few students as an area for improvement.

##### **Recommendation**

Consider some example responses to the online tests to demonstrate varying levels of response.

#### Feedback from SUTE and Unit Coordinator

##### **Feedback**

The unit includes authentic real-world problems throughout the content and assessment tasks.

##### **Recommendation**

Continue to include real-world clinical scenarios in quizzes and unit content.

#### Feedback from CQUniversity Student Academic Integrity Policy and Procedure

##### **Feedback**

The current assessment strategy of online tests does not require 'at the ready' level of knowledge and provides opportunities for breaches of academic integrity.

##### **Recommendation**

Consider assessment strategies that will minimise opportunities for academic integrity breaches, such as supervised closed-book tests.

#### Feedback from Unit teaching team

##### **Feedback**

Post-processing steps that are required for labs are sometimes unfamiliar or unclear.

##### **Recommendation**

Consider some additional pictorial guides for specific post-processing requirements in labs.

## Unit Learning Outcomes

### **On successful completion of this unit, you will be able to:**

1. Use technical terminology correctly in describing radiographic image appearances
2. Apply concepts of image geometry, differential attenuation, scatter production and equipment operation to control radiographic image appearances
3. Make reasoned adjustments to technical factor selections according to the attenuating properties of the structures being imaged and the requirements of the imaging system
4. Discuss at a basic level the clinical operation of the various digital radiographic image receptors and processing systems
5. Discuss at a basic level core concepts of digital image properties, display, manipulation and storage.

This unit links to the following Professional Capabilities for Medical Radiation Practitioners as detailed by the Medical Radiation Practice Board of Australia (effective March 2020):

- *Domain 1:2 Use clinical information management systems appropriately (parts b and e).*
- *Domain 1:6 Implement techniques for patient/client stabilisation and reproducibility of procedures and outcomes (part a).*
- *Domain 1A:1 Perform projection radiography in a range of setting (parts a,b,c,d,f,g).*
- *Domain 1A:2 Perform fluoroscopy and angiography examinations in a range of settings (part d).*
- *Domain 5:1 Perform and provide safe radiation practice (parts c and d).*

## Alignment of Learning Outcomes, Assessment and Graduate Attributes

 N/A Level	 Introductory Level	 Intermediate Level	 Graduate Level	 Professional Level	 Advanced Level
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### Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes				
	1	2	3	4	5
1 - Online Test - 40%	•	•			
2 - In-class Test(s) - 60%	•	•	•	•	•

### Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes				
	1	2	3	4	5
1 - Communication	•	•	•	•	•
2 - Problem Solving		•	•		
3 - Critical Thinking					
4 - Information Literacy					
5 - Team Work					
6 - Information Technology Competence		•		•	•
7 - Cross Cultural Competence					
8 - Ethical practice					
9 - Social Innovation					
10 - Aboriginal and Torres Strait Islander Cultures					

## Textbooks and Resources

### Textbooks

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#### Supplementary

##### **Essentials of Radiographic Physics & Imaging**

Edition: 3rd (2020)

Authors: James Johnston and Terri Fauber

Elsevier

St. Louis , Missouri , USA

ISBN: 9780323566681

Binding: Hardcover

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#### Supplementary

##### **Radiography in the Digital Age: Physics - Exposure - Radiation Biology**

Edition: 3rd (2018)

Authors: Quinn B. Carroll

Charles C. Thomas Publisher

Springfield , Illinois , USA

ISBN: 9780398092146

Binding: eBook

#### Additional Textbook Information

The text by Carroll will be used regularly in multiple second year units: MEDI12002 Science & Instrumentation 1, MEDI12005 Science & Instrumentation 2 plus MEDI12001 Radiation Science. It is freely available online through the unit eReading List. The eBook version of this text can be purchased through the publisher's website

[https://www.ccthomas.com/details.cfm?P\\_ISBN13=9780398092146](https://www.ccthomas.com/details.cfm?P_ISBN13=9780398092146).

The text by Johnston and Fauber may be used at times and will be available through the CQUniversity Library (hardcopy) & unit eReading List (online).

### IT Resources

**You will need access to the following IT resources:**

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- CQUniversity PACS

## Referencing Style

All submissions for this unit must use the referencing style: [Vancouver](#)

For further information, see the Assessment Tasks.

## Teaching Contacts

**Linden Williams** Unit Coordinator

[l.williams@cqu.edu.au](mailto:l.williams@cqu.edu.au)

**Carolyn Agioritis** Unit Coordinator

[c.e.agioritis@cqu.edu.au](mailto:c.e.agioritis@cqu.edu.au)

## Schedule

### Week 1 - 06 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
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### Radiographic image properties and the imaging process

- differential attenuation
- the radiograph as an attenuation map
- image properties (visibility, density, brightness, contrast, unsharpness or blur, spatial resolution, distortion)
- imaging workflow
- introduction to the digital image

"Radiography in the Digital Age" - selected readings from Chapters 11,12,13.

Refer to Moodle for specific pages and any additional readings.

Lab & tutorial:

- orientation to the radiographic laboratory and PACS
- image properties

### Week 2 - 13 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<b>Image Geometry - distortion</b> <ul style="list-style-type: none"><li>• radiographic image geometry</li><li>• positioning of the beam, part and image receptor to control radiographic appearances of spatial relationships</li><li>• effects of image geometry on the image (superimposition, magnification and shape distortion)</li></ul>	<p>"Radiography in the Digital Age" - selected readings from Chapters 14 and 24.</p> <p>Refer to Moodle for specific pages and any additional readings.</p>	Lab & tutorial - geometric distortion

### Week 3 - 20 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<b>Image Geometry - unsharpness</b> <ul style="list-style-type: none"><li>• line focus principle</li><li>• effective vs actual focal spot size</li><li>• effect of focal spot size</li><li>• effect of image geometry</li><li>• unsharpness and visibility</li><li>• absorption blur, motion blur</li><li>• spatial resolution</li></ul>	<p>"Radiography in the Digital Age" - selected readings from Chapters 14, 15, 9, 21, 24.</p> <p>Refer to Moodle for specific pages and any additional readings.</p>	Lab & tutorial - unsharpness and spatial resolution

### Week 4 - 27 Mar 2023

Module/Topic	Chapter	Events and Submissions/Topic
<b>Scatter on the radiographic image</b> <ul style="list-style-type: none"><li>• control of scatter production</li><li>• collimation and positive beam limitation</li><li>• control of scatter to the image receptor</li><li>• air gap technique</li><li>• effect of scatter on visibility</li><li>• contrast resolution</li></ul>	<p>"Radiography in the Digital Age" - selected readings from Chapters 18 and 20.</p> <p>Refer to Moodle for specific pages and any additional readings.</p>	Lab & tutorial - scatter on images

### Week 5 - 03 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
<b>Control of scatter using grids</b> <ul style="list-style-type: none"><li>• grid construction and types</li><li>• grid use</li><li>• grid errors</li><li>• technical factor compensation</li><li>• grid metrics</li></ul>	<p>"Radiography in the Digital Age" - selected readings from Chapter 20.</p> <p>Refer to Moodle for specific pages and any additional readings.</p>	Lab & tutorial - grid use

### Vacation Week - 10 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
Break week		

### Week 6 - 17 Apr 2023

Module/Topic	Chapter	Events and Submissions/Topic
Assessment week - no new content		No lab or tutorial
		<b>Online Test</b> Due: Week 6 Wednesday (19 Apr 2023) 11:00 am AEST

**Week 7 - 24 Apr 2023**

Module/Topic	Chapter	Events and Submissions/Topic
<b>Digital radiographic imaging</b> <ul style="list-style-type: none"> <li>• properties of the digital radiograph</li> <li>• digital radiography process of acquisition, processing and display</li> <li>• visibility of displayed image</li> <li>• PACS systems and PACS workflow</li> <li>• DICOM</li> </ul>	<p>"Radiography in the Digital Age" - selected readings from Chapters 28, 29, 36.</p> <p>Refer to Moodle for specific pages and any additional readings.</p>	<p>No lab</p> <p>Tutorial - digital radiographic imaging</p>

**Week 8 - 01 May 2023**

Module/Topic	Chapter	Events and Submissions/Topic
<b>Digital radiographic image receptor systems</b> <ul style="list-style-type: none"> <li>• computed radiography</li> <li>• image reader</li> <li>• direct read radiography</li> </ul>	<p>"Radiography in the Digital Age" - selected readings from Chapter 34.</p> <p>Refer to Moodle for specific pages and any additional readings.</p>	<p>Lab &amp; tutorial - digital image acquisition</p>

**Week 9 - 08 May 2023**

Module/Topic	Chapter	Events and Submissions/Topic
<b>Radiographic exposure technique (1)</b> <ul style="list-style-type: none"> <li>• control of radiation quantity to the image receptor</li> <li>• exposure index and deviation index</li> <li>• control of differential attenuation</li> <li>• effects of kV and mAs change on the recorded image</li> <li>• noise, mottle and visibility</li> </ul>	<p>"Radiography in the Digital Age" - selected readings from Chapters 15, 16, 32.</p> <p>Refer to Moodle for specific pages and any additional readings.</p>	<p>Lab &amp; tutorial - effects of mAs and kV change</p>

**Week 10 - 15 May 2023**

Module/Topic	Chapter	Events and Submissions/Topic
<b>Radiographic exposure technique (2)</b> <ul style="list-style-type: none"> <li>• control of tube heating</li> <li>• basics of automatic exposure control</li> <li>• exposure technique charts and anatomical programming</li> <li>• SID changes and direct square law</li> </ul>	<p>"Radiography in the Digital Age" - selected readings from Chapters 9, 21, 22, 27.</p> <p>Refer to Moodle for specific pages and any additional readings.</p>	<p>Lab &amp; tutorial - other determinants of beam quality and quantity</p>

**Week 11 - 22 May 2023**

Module/Topic	Chapter	Events and Submissions/Topic
<b>Selection of exposure factors</b> <ul style="list-style-type: none"> <li>• impact of body part content and size</li> <li>• exponential attenuation</li> <li>• formulation of an exposure technique chart</li> <li>• circumstances requiring exposure technique modification</li> </ul>	<p>"Radiography in the Digital Age" - selected readings from Chapters 11, 19, 26.</p> <p>Refer to Moodle for specific pages and any additional readings.</p>	<p>Lab &amp; tutorial - exposure technique chart formulation</p>

**Week 12 - 29 May 2023**

Module/Topic	Chapter	Events and Submissions/Topic
Revision/Consolidation		Lab & tutorial - putting it all together

**Review/Exam Week - 05 Jun 2023**

Module/Topic	Chapter	Events and Submissions/Topic
		<p><b>In-class Test</b> Due: Review/Exam Week Friday (9 June 2023) 12:00 pm AEST</p>

## Term Specific Information

This unit is designed to be taken concurrently with MEDI12001 Radiation Science and content from that unit will be referred to and used to develop understanding of the content in this unit. You are expected to spend on average 10 - 12 hours of time each week in your study activities for this unit. A suggested time budget for weekly study is:

- Assigned reading: 1-2 hours
- Watching and taking notes from recorded lectures: 2 hours
- Labs (preparation, lab time, group time): 2 hours
- Tutorial preparation and participation: 2 hours
- Creating your own study notes to meet weekly learning goals using lectures, tutorials, readings and other Moodle resources: 2-3 hours

You will also need to spend time throughout term in revision and preparation for the online tests.

When attending lab classes you will be required to adhere to all occupational health and safety requirements related to the use of the Medical Imaging laboratories, including completion of the mandatory radiation safety and lab inductions prior to your first session. You are required to adhere to the Medical Imaging Dress Code for all lab classes.

There is no attendance requirement for any classes in this unit. Tutorials are interactive sessions where your participation enables you to check your understanding of and your ability to apply the week's concepts and for you to build your skills in responding to test questions. Tutorials are closely related to the lab for the week. Your regular and active participation in both labs and tutorials strongly supports your success in the unit. Labs and tutorials are not recorded for this on-campus unit.

## Assessment Tasks

### 1 Online Test

#### Assessment Type

Online Test

#### Task Description

You will complete an online test in Week 6 to demonstrate your ability to apply the concepts and use the terminology from **Weeks 1 - 5** of the unit. All questions will be based on the posted weekly learning goals and may include analysis of diagrams, photographs and/or radiographs. Questions may include quiz-style questions (for example multiple choice, fill-in-the-blank, matching), true/false with explanation and written response. Written response questions will be of a similar type to those discussed in weekly tutorials and will require you to apply your knowledge and understanding to a given scenario.

**This is an open-book test.** It means that during the test you may access your study notes, textbook, the unit Moodle site and/or any website. **The standards of academic integrity still apply.** All responses must be your own work. Colluding with other students on non-group work is considered academic misconduct. Just as for written assignments, you must also acknowledge intellectual content in your answers that is not your own work. Basic statements of facts are considered 'common knowledge' in the context of this unit so they do not need to be cited. However, *if you copy any explanation content word-for-word from ANY source, you must put that content in quotation marks and formally cite your source.* Although this is an open-book test, the expectation is that you will be familiar with the unit content and concepts. You should not assume you will have time to look up the answer to every question.

**The Moodle online test availability period will be between 9 am - 11 am AEST on Wednesday 19th April 2023.** Once you open the test, you will have 90 minutes to complete it, up to the stated due date/time. All unfinished tests will be automatically submitted at that time.

As per the Assessment Procedures, this test must be completed at the timetabled date and time. There is no opportunity to apply a late penalty. In the absence of an approved extension, you cannot complete this assessment at a later time and you will receive a mark of zero for the assessment if you have not submitted it by the scheduled date and time. If you start the test late, you will still be required to submit at the stated closing time.

#### Assessment Due Date

Week 6 Wednesday (19 Apr 2023) 11:00 am AEST



## Return Date to Students

Week 8 Wednesday (3 May 2023)

## Weighting

40%

## Assessment Criteria

Question responses will be scored on the following criteria:

- correct use of terminology
- correct selection and application of core concepts to the specific content of the question
- clarity, correctness, relevance and completeness of the response in addressing the question that was asked
- critical thinking

The number of marks for each question are allocated based on the depth and breadth of the required response, and will be indicated on the online test.

## Referencing Style

- [Vancouver](#)

## Submission

Online

## Learning Outcomes Assessed

- Use technical terminology correctly in describing radiographic image appearances
- Apply concepts of image geometry, differential attenuation, scatter production and equipment operation to control radiographic image appearances

# 2 In-class Test

## Assessment Type

In-class Test(s)

## Task Description

This assessment is an **in-class, closed-book, online Moodle test** taking place on **Friday of Week 13**.

As health care professionals, radiographers must consider many variables during the radiographic imaging process and be able to apply their technical knowledge and skills to solve problems as they present clinically. This test includes assessment of content that you should have as 'ready knowledge' in preparation for entry to your first clinical placement. This is material that you should not need to look up or ask others, so this is a closed-book supervised test.

This test will allow you to demonstrate your knowledge of, and ability to apply the concepts and use the terminology from all weeks of the unit, with an emphasis on Weeks 5-11. All questions will be based on the posted weekly learning goals and may include analysis of diagrams, photographs and/or radiographs. Questions may include quiz-style questions (for example multiple choice, fill-in-the-blank, matching), true/false with explanation and written response. Written response questions will be of a similar type to those discussed in weekly tutorials and will require you to apply your knowledge and understanding to a given scenario.

This is a 90 minute test. You will sit this test at your timetabled assessment time on the due date. There are two back-to-back sittings of this test so your test start and end time will depend on your registered session. You should be in attendance at your allocated room 10 minutes prior to your registered session. Further instructions will be provided in Moodle.

This test must be written at the timetabled date and time. As per the Assessment Procedures, this task is to be completed during a defined period. There is no opportunity to apply a late penalty. If you arrive late, you may enter the test room up to 30 minutes after the start of the test; however, you will still be required to submit your test at the standard test end time. You will not be allowed entry more than 30 minutes after the test starts. In the absence of an approved extension, you cannot complete this assessment at a later time, and you will receive a mark of zero for the assessment if you have not completed it by the scheduled date and time. If you have an approved extension, you will be assigned a new test date and time as soon as possible after the original test date, according to availability of a test supervisor and an appropriate room. It is your responsibility to ensure that you can attend at that new assigned date/time. Please see Section 5 of the the University's Assessment Policy and Procedure for details regarding Assessment Management, specifically around assessment extension.

## Assessment Due Date

Review/Exam Week Friday (9 June 2023) 12:00 pm AEST

**Return Date to Students**

Feedback and test results will be available 2 weeks after date of test.

**Weighting**

60%

**Minimum mark or grade**

50%

**Assessment Criteria**

Question responses will be scored on the following criteria:

- correct use of terminology
- correct selection and application of core concepts to the specific content of the question
- clarity, correctness, relevance and completeness of the response in addressing the question that was asked
- critical thinking

The number of marks for each question are allocated based on the depth and breadth of the required response, and will be indicated on the online Moodle test.

**Referencing Style**

- [Vancouver](#)

**Submission**

Online

**Learning Outcomes Assessed**

- Use technical terminology correctly in describing radiographic image appearances
- Apply concepts of image geometry, differential attenuation, scatter production and equipment operation to control radiographic image appearances
- Make reasoned adjustments to technical factor selections according to the attenuating properties of the structures being imaged and the requirements of the imaging system
- Discuss at a basic level the clinical operation of the various digital radiographic image receptors and processing systems
- Discuss at a basic level core concepts of digital image properties, display, manipulation and storage.

## Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the [Student Academic Integrity Policy and Procedure](#). This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

### What is a breach of academic integrity?

A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

### Why is academic integrity important?

A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

### Where can I get assistance?

For academic advice and guidance, the [Academic Learning Centre \(ALC\)](#) can support you in becoming confident in completing assessments with integrity and of high standard.

### What can you do to act with integrity?



#### Be Honest

If your assessment task is done by someone else, it would be dishonest of you to claim it as your own



#### Seek Help

If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)



#### Produce Original Work

Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem