



# MEDI12005 *Science and Instrumentation 2*

## Term 2 - 2024

Profile information current as at 05/09/2024 02:25 pm

All details in this unit profile for MEDI12005 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 builds on Science and Instrumentation 1 (MEDI12001) and aims to provide you with insights about the x-ray generator and timing circuit in the digital environment. You will learn to apply concepts such as digital image processing, histogram analysis, post-processing and artificial intelligence (AI) to control radiographic image appearances. You will also be introduced to the physical and operational principles of specialised equipment such as orthopantomography (OPG), bone mineral densitometry, mammography, mobile and fluoroscopic systems. This unit will help you understand how image quality and dose can be influenced for fluoroscopic systems.

### 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

Prerequisites: MEDI12001 Radiation Science and MEDI12002 Science and Instrumentation 1

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 2 - 2024

- 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 Coordinator reflection

**Feedback**

Some students found the post-tutorial bite size explanation (BSE) videos very helpful in explaining topics that they were having trouble with.

**Recommendation**

Continue with the provision of the post-tutorial bite size explanation (BSE) videos in future iterations of the unit to assist students with understanding the topics that they struggle with.

#### Feedback from Coordinator reflection Informal feedback from students

**Feedback**

The revamped 2 hr lab intensive session was well received by the students and assisted them in consolidating topics related to image processing and post-processing.

**Recommendation**

Continue with the adaptation of the 2 hr lab intensive session to support students in consolidating topics related to image processing and post-processing.

#### Feedback from Informal feedback from students Student Activity Monitor (SAM) data

**Feedback**

Some students preferred to study the unit by referring to the pdf documents of the lecture slides instead of watching the recorded lectures.

**Recommendation**

Encourage students to maximize their understanding by actively engaging with recorded lecture videos, fostering a deeper comprehension of course material beyond the confines of lecture slides.

## Unit Learning Outcomes

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

1. Relate the main sub-components of the x-ray generator to the overall generator operation and the controlled production of radiation
2. Outline the use of automatic exposure timing devices in controlling the duration and quantity of a given exposure and the safe operation of a digital radiographic unit
3. Apply concepts such as exposure index, pre-processing and correction, histogram analysis, post-processing and artificial intelligence (AI) to control radiographic image appearances
4. Discuss the design and operational features of the orthopantomography (OPG), bone mineral densitometry, mammography, mobile and fluoroscopic units
5. Discuss the control of image quality and radiation dose in fluoroscopic imaging systems.

The 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: 3 Understand and apply the different methods of imaging and treatment (Part a & b)
- Domain 1A: 1 Perform projection radiography in a range of settings (Parts a, d, e & f)
- Domain 1A: 2 Perform fluoroscopy and angiography examinations in a range of settings (Parts a, d & e)

## Alignment of Learning Outcomes, Assessment and Graduate Attributes



### 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

MEDI12005

#### Supplementary

#### **Radiography in the Digital Age**

Edition: 4th (2023)

Authors: Carroll, Quinn B

Charles C Thomas Publisher Ltd

Springfield , Illinois , USA

ISBN: 9780398094089

The textbook Radiography in the Digital Age is used for multiple second year units: MEDI12001 Radiation Science, MEDI12002 Science & Instrumentation 1 and MEDI12005 Science & Instrumentation 2. The textbook is available for student access as eBook through the Library.

### IT Resources

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

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

## Referencing Style

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

For further information, see the Assessment Tasks.

## Teaching Contacts

**Reshmi Kumar** Unit Coordinator

[r.d.kumar@cqu.edu.au](mailto:r.d.kumar@cqu.edu.au)

## Schedule

### Vacation Week - 12 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
University Break Week		

### Week 6 - 19 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
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Module 1: Controlling radiographic image appearances - Part 1

- Overview of main stages of image data processing between acquisition and display
- Introduction to artificial intelligence (AI) in medical imaging
- Pre-processing and correction
- Generation of image histogram
- Histogram analysis
- Relationship between histogram and exposure index (EI)
- Histogram adjustments and their impact on image data and the displayed image
- Region of interest(ROI) segmentation

See Unit Moodle site for assigned reading from online resources.

Tutorial 1

### Week 7 - 26 Aug 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 2: Controlling radiographic image appearances - Part 2 <ul style="list-style-type: none"> <li>• Point processing and local processing of image matrix data</li> <li>• Grayscale mapping using look up table (LUT)</li> <li>• Grayscale mapping in image window adjustment</li> <li>• Spatial location filtering: Convolution</li> <li>• Spatial frequency filtering: High-pass versus low-pass filtering</li> <li>• Spatial frequency processing: Unsharp masking</li> <li>• Geometric operations</li> <li>• Advantages and disadvantages of post-processing</li> </ul>	See Unit Moodle site for assigned reading from online resources.	Tutorial 2 Lab 1 (Attend only one session in either Week 7 or 8)

### Week 8 - 02 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 3: X-ray generators and timing circuits <ul style="list-style-type: none"> <li>• Review of basic x-ray circuit</li> <li>• Sub-components of an x-ray generator and their role(s) in x-ray production</li> <li>• Overall generator operation in controlling production of x-ray</li> <li>• Application, advantages and disadvantages of automatic exposure timing devices in x-ray systems</li> </ul>	See Unit Moodle site for assigned reading from online resources.	Tutorial 3 Lab 1 (Attend only one session in either Week 7 or 8)

### Week 9 - 09 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
Module 4: Mammography systems <ul style="list-style-type: none"> <li>• Major design features</li> <li>• Factors/principles associated with operation</li> <li>• Technical factors influencing image quality and patient dose</li> <li>• Advantages and disadvantages</li> </ul>	See Unit Moodle site for assigned reading from online resources.	Tutorial 4  <b>Online Test</b> Due: Week 9 Wednesday (11 Sept 2024) 10:15 am AEST

### Week 10 - 16 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
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Module 5: Orthopantomography (OPG), bone mineral densitometry (BMD) and mobile units

- Constructional features and operation
- Technical considerations
- Common errors and artifacts encountered with OPG units
- Advantages and disadvantages

See Unit Moodle site for assigned reading from online resources.

Tutorial 5

### Week 11 - 23 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
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Module 6: Fluoroscopic imaging systems - Part 1

- Principle of fluoroscopy
- System configurations
- Image intensifier coupled with digital imaging chain vs flat panel detector (FPD) system
- Technical considerations for effective use of fluoroscopic systems
- Control of image quality and dose optimisation

See Unit Moodle site for assigned reading from online resources.

Tutorial 6

### Week 12 - 30 Sep 2024

Module/Topic	Chapter	Events and Submissions/Topic
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Review & consolidation

Tutorial 7

### Review/Exam Week - 07 Oct 2024

Module/Topic	Chapter	Events and Submissions/Topic
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### Exam Week - 14 Oct 2024

Module/Topic	Chapter	Events and Submissions/Topic
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Assessment week

**In-class Test** Due: Exam Week  
Monday (14 Oct 2024) 1:00 pm AEST

## Term Specific Information

MEDI12005: Science & Instrumentation 2 is a condensed unit that runs from Weeks 6-12, as most of you are on placement during the first half of term. Being a six-credit unit, you are expected to commit 150 hours to the unit, which equates to about 18-20 hours per week over the 7 weeks. A suggested breakdown of your time would be:

- 4 hours for watching recorded lectures
- 3.5 - 4 hours for completing assigned reading
- 2 - 3 hours for completing other posted learning activities
- 3 hours for creating study notes to meet weekly learning goals using lectures and readings
- 2 hours for working on posted tutorial questions in preparation for tutorial
- 1.5 hours for participation in tutorial
- 3 hours for preparation and/or revision for online tests

There will be a two-hour lab held between Weeks 7 and 8 on the topic "Controlling radiographic image appearances". You are to attend only one of the lab sessions scheduled in either Week 7 or Week 8. Take note that you are to adhere to the Course Dress Code when using the Medical Imaging simulation labs and a zero-tolerance policy will be followed.

The material covered in Weeks 9-12 is foundation knowledge for MEDI12006 Imaging Procedures 2.

The first online test will be held in Week 9 and the End of term In-class test will be held in Week 14. To help you prepare for the two assessments, it is suggested that you spend at least a total of 30 hours for revision (i.e. 10 hours for the first test and 20 hours for the second test).

There will be weekly tutorials held from Weeks 6 - 12. Take note that these tutorials are interactive sessions where your participation enables you to check your understanding of and your ability to apply the weekly concepts and for you to build your skills in responding to test questions. Your regular and active participation strongly supports your success in the unit.

## Assessment Tasks

### 1 Online Test

#### Assessment Type

Online Test

#### Task Description

You will complete an online test on **Wednesday 11 September 2024 in Week 9**. This test will be available from 9:00am to 10:15am AEST. The test is a timed test that will begin once you've opened it, and will be for a duration of 60 minutes, closing automatically when the 60 minutes is up (or at the 10:15am closing time, whichever comes first). Any unanswered questions or unsaved responses will receive a mark of zero. Take note that you have until 9:15am AEST to log on to the test to utilise the full 60 minutes.

This test contributes 40% towards your final unit grade. The aim of the test is for you to demonstrate your ability to apply the concepts and use the terminology covered from Weeks 6-8 (Modules 1 -3) of the unit. All questions will be based on the posted weekly learning goals. The question tasks will be of similar type to those discussed in weekly tutorials and will require you to apply your knowledge and understanding, rather than to simply recall facts. These tasks may include analysis of diagrams and photographs to explain and discuss concepts. There will be a mixture of problem solving and application of concepts type questions.

**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. During the test you may not consult with any other person via any means or accept any input or assistance from any other person, group or artificial intelligence (AI) regarding the test questions and your responses. Colluding with other students on non-group work is considered academic misconduct. Just as for written assignments, you must 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. Take note that at the start of the test, you will need to make a declaration that you understand these rules of academic integrity and that you agree to abide by them. Any identified cases of potential collusion will result in a breach of academic



integrity case being raised. 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.

As per the Assessment Procedures, this test must be written 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 9 Wednesday (11 Sept 2024) 10:15 am AEST

**Return Date to Students**

Week 11 Wednesday (25 Sept 2024)

**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**

- Relate the main sub-components of the x-ray generator to the overall generator operation and the controlled production of radiation
- Outline the use of automatic exposure timing devices in controlling the duration and quantity of a given exposure and the safe operation of a digital radiographic unit
- Apply concepts such as exposure index, pre-processing and correction, histogram analysis, post-processing and artificial intelligence (AI) to control radiographic image appearances

## 2 In-class Test

**Assessment Type**

In-class Test(s)

**Task Description**

**Take note that this is a closed-book on-campus supervised test.** You will complete an in-class, closed-book, online Moodle test on **Monday 14th October 2024 in Week 14 (Exam week)** to demonstrate your ability to apply concepts and terminology learned in the unit.

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 9-12. 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. The question tasks will be of similar type to those discussed in weekly tutorials and will require you to apply your knowledge and understanding, rather than to simply recall facts.

**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 at the start time of 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 University's Assessment Policy and Procedure for details regarding Assessment Management, specifically around assessment extension.

**Assessment Due Date**

Exam Week Monday (14 Oct 2024) 1:00 pm AEST

**Return Date to Students**

Two weeks after final 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 test.

**Referencing Style**

- [Vancouver](#)

**Submission**

Online

**Learning Outcomes Assessed**

- Relate the main sub-components of the x-ray generator to the overall generator operation and the controlled production of radiation
- Outline the use of automatic exposure timing devices in controlling the duration and quantity of a given exposure and the safe operation of a digital radiographic unit
- Apply concepts such as exposure index, pre-processing and correction, histogram analysis, post-processing and artificial intelligence (AI) to control radiographic image appearances
- Discuss the design and operational features of the orthopantomography (OPG), bone mineral densitometry, mammography, mobile and fluoroscopic units
- Discuss the control of image quality and radiation dose in fluoroscopic imaging systems.

## 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