



MEDS12001 *Physics of Ultrasound*

Term 1 - 2017

Profile information current as at 03/05/2024 09:10 pm

All details in this unit profile for MEDS12001 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

You will be introduced to the principles of ultrasound physics and instrumentation in this unit. Quality Assurance and recognition of artefacts will also be covered. The knowledge and skills learnt from this unit are integral to all concurrent and subsequent sonography units and the foundation from which you will build your image acquisition, recognition and assessment skills. You will apply your knowledge and skills of physics principles in the laboratory setting using ultrasound equipment.

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

Prerequisite MEDI11002 Physics for Health Sciences AND MEDS11001 Fundamentals of Sonographic Practice

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 - 2017

- Brisbane
- Mackay
- Melbourne
- Sydney

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. **Written Assessment**

Weighting: 40%

2. **Practical Assessment**

Weighting: Pass/Fail

3. **Examination**

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 "Have your say' course evaluation.

Feedback

More time required for the final written exam

Recommendation

Revise question number

Action

Long answers were removed with more short answer questions given. This provided more opportunity to assess knowledge across more areas.

Feedback from "Have your say' course evaluation.

Feedback

Due to the tutorial lab tutor: student ratios, it would be good to have videos of what is expected during the lab sessions, so we know what we are doing

Recommendation

Create videos for the 3 lab sessions showing examples of what is expected during each lab

Action

Labs were simplified and more instructions provided in the content

Feedback from "Have your say' course evaluation.

Feedback

Lab tutors at some campuses unable to explain concepts

Recommendation

Counsel and support various campus staff with regard to the content resources and delivery of this unit so they can support the students more

Action

More 'tutor' support provided on the lab manual in the form of model answers, suggestive questions.

Feedback from "Have your say' course evaluation.

Feedback

Weekly quizzes would help provide feedback to see how we are going

Recommendation

Consider creating formative quizzes that students can use to guide their learning

Action

Formative image optimisation quizzes and content quizzes were added as an option.

Feedback from "Have your say' course evaluation.

Feedback

More images would be good

Recommendation

Consider including more images into lectures and tutorials

Action

More images added to tutorials, and quizzes

Unit Learning Outcomes

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

1. Apply the physical principles of diagnostic ultrasound to practical problems
2. Evaluate the components and performance of diagnostic ultrasound equipment
3. Apply knowledge of ultrasound physics and practical skills to acquire diagnostic ultrasound images
4. Discuss the principles of ultrasound techniques, Doppler ultrasound and its application in medical ultrasound.
5. Interpret the causes of, and apply problem solving skills to reduce, sources of artefacts on an ultrasound image
6. Describe safety issues in medical ultrasound

This unit will be one of the core units in the Medical Sonography Course which is externally accredited by the Australian Sonographers Accreditation Registry (ASAR), an external professional regulatory body. Intended learning outcomes have been linked to:

ASAR Required Graduate Competency Outcomes for General Sonography Accreditation Standards 1.2,

Deliver safe, patient centred services- 1, 2, 3, 4, 5, 6 and 7

Practice within professional and ethical frameworks- 2, 6 and 7

Contribute to workplace health and safety and quality assurance- 2, and 7

Alignment of Learning Outcomes, Assessment and Graduate Attributes



Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes					
	1	2	3	4	5	6
1 - Written Assessment - 40%	•	•	•	•	•	•
2 - Practical Assessment - 0%	•	•	•			
3 - Examination - 60%	•	•		•	•	•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
1 - Communication	•	•	•	•	•	•
2 - Problem Solving	•	•	•	•	•	•
3 - Critical Thinking						
4 - Information Literacy	•	•	•	•	•	•
5 - Team Work						
6 - Information Technology Competence	•	•	•	•	•	•
7 - Cross Cultural Competence						

Graduate Attributes	Learning Outcomes					
	1	2	3	4	5	6
8 - Ethical practice						
9 - Social Innovation						
10 - Aboriginal and Torres Strait Islander Cultures						

Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - Written Assessment - 40%	•	•		•		•				
2 - Practical Assessment - 0%	•	•	•	•		•				
3 - Examination - 60%	•	•		•						

Textbooks and Resources

Textbooks

MEDS12001

Prescribed

The Physics and Technology of Diagnostic Ultrasound- A Practitioner's Guide

Edition: 1 (2012)

Authors: Rob Gill

High Frequency Publishing

Sydney , NSW , Australia

ISBN: ISBN: 9780987292100

Binding: Paperback

Additional Textbook Information

This text will supplement lecture material. E-book or hardcopy acceptable.

[View textbooks at the CQUniversity Bookshop](#)

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- CQUniversity's Picture Archiving and Communication System (PACS)
- Endnote Software

Referencing Style

All submissions for this unit must use the referencing style: [American Psychological Association 6th Edition \(APA 6th edition\)](#)

For further information, see the Assessment Tasks.

Teaching Contacts

Gerrie Beirne Unit Coordinator
g.beirne@cqu.edu.au

Schedule

Week 1 - 06 Mar 2017

Module/Topic	Chapter	Events and Submissions/Topic
Ultrasound Interaction with Tissue	Chapter 1 & 2	One hour Zoom tutorial will run on Mondays from 13:00 AEST (Queensland) / 14:00 DST (Syd, Melb) Content: Informal Zoom tutorial and assessment overview

Week 2 - 13 Mar 2017

Module/Topic	Chapter	Events and Submissions/Topic
Pulsed Ultrasound and Imaging	Chapter 3	

Week 3 - 20 Mar 2017

Module/Topic	Chapter	Events and Submissions/Topic
Transducers	Chapter 4	Lab session 1 One hour Zoom tutorial will run on Mondays from 13:00 AEST (Queensland) / 14:00 DST (Syd, Melb) Content: Weeks 1 and 2

Week 4 - 27 Mar 2017

Module/Topic	Chapter	Events and Submissions/Topic
Ultrasound Instrumentation	Chapter 5 study notes	Upload your lab manual via Moodle link provided

Week 5 - 03 Apr 2017

Module/Topic	Chapter	Events and Submissions/Topic
Image Artifacts	Chapter 6	One hour Zoom tutorial will run on Mondays from 13:00 AEST Content: Weeks 3 and 4. Lab 1 review.

Vacation Week - 10 Apr 2017

Module/Topic	Chapter	Events and Submissions/Topic
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Week 6 - 17 Apr 2017

Module/Topic	Chapter	Events and Submissions/Topic
Doppler Ultrasound	Chapter 7	Lab session 2

Week 7 - 24 Apr 2017

Module/Topic	Chapter	Events and Submissions/Topic
Doppler Artifacts	Chapter 8	One hour Zoom tutorial will run on Mondays from 13:00 AEST Content: Weeks 5 and 6. Lab 2 review. Upload your lab manual via Moodle link provided

Week 8 - 01 May 2017

Module/Topic	Chapter	Events and Submissions/Topic
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Haemodynamic Concepts	Chapter 9	One hour Zoom tutorial will run on Mondays from 13:00 AEST Content: General Q and A for written assessment.
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Week 9 - 08 May 2017

Module/Topic	Chapter	Events and Submissions/Topic
Equipment performance	Chapter 10	One hour Zoom tutorial will run on Mondays from 13:00 AEST Content: Weeks 7 and 8. Written assessment Due: Week 9 Friday (12 May 2017) 11:45 pm AEST

Week 10 - 15 May 2017

Module/Topic	Chapter	Events and Submissions/Topic
Bioeffects and Safety	Chapter 11	

Week 11 - 22 May 2017

Module/Topic	Chapter	Events and Submissions/Topic
Additional Modes and Capabilities	Chapter 12	Written assessment results and feedback. Lab session 3 One hour Zoom tutorial will run on Mondays from 13:00 AEST Content: Weeks 9 and 10. General assessment feedback.

Week 12 - 29 May 2017

Module/Topic	Chapter	Events and Submissions/Topic
Revision week		One hour Zoom tutorial will run on Mondays from 13:00 AEST Content: Weeks 11. Lab 3 review. Revision and preparation for final written exam. Upload your lab manual via Moodle link provided

Review/Exam Week - 05 Jun 2017

Module/Topic	Chapter	Events and Submissions/Topic

Exam Week - 12 Jun 2017

Module/Topic	Chapter	Events and Submissions/Topic
Final Exam		

Term Specific Information

The course coordinator for MED12001, Term 1, 2017 is Gerrie Beirne.

The best way to contact Gerrie is by email at g.beirne@cqu.edu.au.

Gerrie's CQU telephone number is 02 9324 5056.

Gerrie's office hours are Monday to Friday. Please use email whenever possible. Wednesdays are available for face-to-face meetings by prior arrangement if required.

Access to the internet is required to undertake this course, as course materials, tutorials and updates will be provided via Moodle, email and Collaborate.

Weekly resources will include access to relevant websites, activities and readings, however you will need to acquire the prescribed text to successfully complete this course. To give yourself the best chance of success with this course please ensure that you undertake all the readings and activities.

There will be tutorials on Mondays at 13:00 AEST (14:00 AEDT for SYD and MEL during Daylight savings ENDS SUNDAY WEEK 4) . They will be recorded for those unable to attend.

There are three (3) physics practical labs.

Assessment Tasks

1 Written assessment

Assessment Type

Written Assessment

Task Description

Task Description

This written assessment has thirteen (13) possible questions. You will choose five (5) to answer. Your choice must include at least one (1) question that requires images from your physics practical labs. Subjects covered may be image quality, artifacts, image optimisation, instrumentation or the physics of ultrasound. Images from your physics practical labs may be shared within your lab group. Those images will not be overtly judged on their quality (i.e. containing undesirable artifacts or poorly optimised), but it is assumed that together with your tutor, you shall identify and collect images of reasonable quality. Formulae, flow-charts, diagrams and images may be used to illustrate your answer, even when not specifically asked for.

Word Count is 2000 +/- 10% (e.g.200) words, excluding tables, charts, diagrams and reference list

Background

As a sonographer, you must understand the physical principles which create the images you are acquiring and the artifacts observed during the sonographic imaging process. This helps you improve your images and may help in diagnosis e.g. the posterior shadow from a kidney calculus or the posterior enhancement from a breast cyst. A sonographer must be able to use ultrasound equipment safely, and be familiar with the safety guidelines set by any governing bodies.

Referencing Style

You must use APA in-text referencing system. References for each answer must be included in a References Page at the end of the assignment. Ensure that you reference your answers using at least two (2) different sources for each question. At least one (1) reference must be a primary source for each question. The same reference source may be used for more than one individual question. Contact CQU library staff for guidance if required.

The use of Endnote TM referencing software is expected. Another document will be given for details on how to download and use Endnote TM.

Submission

Via Turnitin using MEDS12001 Moodle site.

File must be in a 'word' file i.e. docx. NOT PDF.

File name <your surname>_<your student number>_MEDS12001assessment

e.g. Beirne_s1234567_MEDS12001assessment

Format

You need to submit the assignment with a cover page stating your:

Name

Student number

Unit code

Campus enrolled

Group members from Physics Lab 1

Start a new page for each question.

Plagiarism

All written work must be demonstrably your own. For those repeating this subject, Self-plagiarism is also viewed harshly by the Office of Learning and Teaching. Images used from MEDS12001 Physics practical labs are permitted with correct referencing. Any work suspected of plagiarism will be reported to the Learning and Teaching Office. Be aware that no Turnitin score is established to rule out plagiarism. An incident of plagiarism may result in reduced marks, a mention on your permanent academic record or other further action that may affect your academic career. Please familiarise yourself with the Academic Misconduct Procedure.

Choice of Questions

Please choose five (5) to complete your assessment

1. Explain the concept of attenuation in different mediums. Describe the concept of posterior acoustic enhancement. Support this with images you obtained in Physics Lab 1.
2. Discuss the benefits and limitations of prospective cine-loop capture versus retrospective cine-loop capture. Give clinically relevant examples to justify your statements.
3. Explain the shape of the ultrasound beam and discuss each dimension of the beam and where the best spatial resolution is achieved. What imaging artifacts arise from machine-based assumptions regarding the ultrasound beam?
4. Discuss the two (2) different types of reverberation. Give examples of how we may use them diagnostically.
5. Explain the concept of aliasing as it relates to Spectral Doppler Imaging.
6. Describe how the FOV can be altered laterally using a linear transducer and how this is achieved. Support this with images with from Physics Lab 1.
7. Discuss different types of resolution utilised in Medical Sonography and Echocardiography. Give examples of their impact on clinical scanning.
8. Describe the differences between Continuous Wave (CW) Doppler and Pulsed Wave (PW) Doppler. What are the clinical limitations of CW Doppler? What are the clinical limitations of PW Doppler?
9. Explain and describe what happens to sound as it encounters soft tissue/air interfaces and soft tissue/bone interfaces (sound transmission and reflection). Use images obtained in Physics lab 1 to support your explanation.
10. Explain the two (2) types of bioeffects of ultrasound within tissue. How do we monitor them during medical diagnostic imaging? Describe how we can adhere to the principles of 'as low as reasonably achievable' (ALARA) as they relate to medical diagnostic ultrasound examinations.
11. Explain the artifact 'anisotropy' as it relates to Medical Sonography and Echocardiography. Include in your answer the cause of 'anisotropy' and any diagnostic benefits or limitations.
12. Discuss Shear Wave Elastography for Evaluation of Liver Fibrosis. Include in your answer the physical principle behind the technology, any diagnostic criteria and its clinical utility.
13. Explain the different machine processes used to create Tissue Doppler Imaging and Speckle Tracking. What limitations of Tissue Doppler Imaging are overcome in Speckle Tracking? What is the clinical utility of each technique?

Assessment Due Date

Week 9 Friday (12 May 2017) 11:45 pm AEST

Be aware that IT support may not be available after hours.

Return Date to Students

Week 11 Friday (26 May 2017)

Written assessment feedback returned via moodle and results available via your moodle gradebook

Weighting

40%

Minimum mark or grade

50%

Assessment Criteria

Each question will be assessed by considering each of the following: Have you answered

the question?

Have you included enough relevant detail? Is the answer accurate?

Have you demonstrated your rationale, including all working out where necessary?

Does your answer indicate that you understand the topic?

Have you adequate support from references?

Is your spelling, grammar and use of vocabulary exemplary? Have you kept to the overall word limit? Individual questions may vary in length.

Are your acquired images of a reasonable quality? Is the assessment an original written work that represents your learning and not copied in anyway?

Referencing Style

- [American Psychological Association 6th Edition \(APA 6th edition\)](#)

Submission

Online

Submission Instructions

Upload via assessment link on moodle.

Learning Outcomes Assessed

- Apply the physical principles of diagnostic ultrasound to practical problems
- Evaluate the components and performance of diagnostic ultrasound equipment
- Apply knowledge of ultrasound physics and practical skills to acquire diagnostic ultrasound images
- Discuss the principles of ultrasound techniques, Doppler ultrasound and its application in medical ultrasound.
- Interpret the causes of, and apply problem solving skills to reduce, sources of artefacts on an ultrasound image
- Describe safety issues in medical ultrasound

Graduate Attributes

- Communication
- Problem Solving
- Information Literacy
- Information Technology Competence

2 Practical Assessment

Assessment Type

Practical Assessment

Task Description

Task Description

These labs will provide an opportunity for you to explore the physical principles of ultrasound and develop your knowledge of machine instrumentation and knobology under the guidance of your tutor.

During the labs you will be required to take images, and observe the effect of changing machine parameters on the resultant image.

You will be required to complete questions in your lab book during the lab.

The questions will be a mixture of closed procedure (fill in the gap) and very short answer. They are designed to help you understand the physical properties of ultrasound and how that knowledge is used to inform the practical production of diagnostic medical images. Your final written examination during Exam Week will be based on the learning in these labs as well as lecture material and textbook content.

Students may work in teams to acquire images. Image sharing within your lab group is permitted.

Please note the following excerpt from the University Assessment of Coursework Procedures:

'...students who fail a single assessment task in a pass-fail course, or who fail a pass-fail component of a graded course will be deemed to have failed that course'

Three (3) physics labs will be held on Thursdays in weeks 3, 6 and 11.

You will be required to UPLOAD your lab booklet answers to the Moodle page via the link provided in the assessment block. Non-attendance at a lab for any reason will require you to complete the learning and practical exercises in your own time for submission to the assessment link.

BRING a USB stick to lab to save your images

Assessment Due Date

At completion of each lab session. 23:45 (AEST) Friday of the week following the practical lab.

Return Date to Students

Answers will be given and discussed at the following week's tutorial

Weighting

Pass/Fail

Minimum mark or grade

Pass

Assessment Criteria

Learners will assess their lab book answers by considering each of the following:

Have you answered the question?

Is the answer accurate?

Does your answer indicate that you understand the practical application of the physical properties of ultrasound and the diagnostic ultrasound machine?

Referencing Style

- [American Psychological Association 6th Edition \(APA 6th edition\)](#)

Submission

Offline Online

Submission Instructions

Upload via Moodle link

Learning Outcomes Assessed

- Apply the physical principles of diagnostic ultrasound to practical problems
- Evaluate the components and performance of diagnostic ultrasound equipment
- Apply knowledge of ultrasound physics and practical skills to acquire diagnostic ultrasound images

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Literacy
- Information Technology Competence

Examination

Outline

Complete an invigilated examination.

Date

During the examination period at a CQUniversity examination centre.

Weighting

60%

Length

120 minutes

Minimum mark or grade

50%

Exam Conditions

Closed Book.

Materials

Calculator - all non-communicable calculators, including scientific, programmable and graphics calculators are authorised

Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).

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