



MEDS12001 *Physics of Ultrasound*

Term 1 - 2024

Profile information current as at 03/09/2024 11:20 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

In this unit, you will be introduced to the principles of ultrasound physics and instrumentation. Ultrasound safety, quality assurance and recognition of artifacts will also be covered. The knowledge and skills learnt from this unit are integral to all concurrent and subsequent sonography and echocardiography units and forms 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 Co requisite MEDS12003 or ECHO12006

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 - 2024

- 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. **Online Quiz(zes)**

Weighting: 40%

2. **Laboratory/Practical**

Weighting: Pass/Fail

3. **Online Test**

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 Teacher Evaluations

Feedback

Some students found that it was difficult to remain engaged during tutorials, as Physics is quite dense.

Recommendation

Construct online quizzes such as Kahoot during tutorials to encourage interaction and engagement.

Feedback from MEDS12001 Q&A forum

Feedback

Some of the older lectures have poor audio quality and are blurry when using different platforms.

Recommendation

Replace older lectures as the audio tends to distort when the volume is too high.

Feedback from MEDS12001 Q&A forum

Feedback

The final Lab session is too rushed.

Recommendation

Some content from Lab 3 can be transferred to Lab 2.

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 optimal ultrasound images, with due regard of safe practices
4. Discuss the principles of ultrasound techniques, Doppler ultrasound and its application in medical ultrasound including safety issues
5. Interpret the causes of, and apply problem solving skills to reduce, sources of artifacts on an ultrasound image.

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
1 - Online Quiz(zes) - 40%	•	•	•		
2 - Laboratory/Practical - 0%	•	•	•	•	•
3 - Online Test - 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					

Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes									
	1	2	3	4	5	6	7	8	9	10
1 - Online Quiz(zes) - 40%	•	•	•					•		
2 - Laboratory/Practical - 0%	•	•	•			•		•		
3 - Online Test - 60%	•	•	•					•		

Textbooks and Resources

Textbooks

MEDS12001

Prescribed

Sonography : principles and instruments

Edition: 10 (2020)

Authors: Frederick W. Kremkau

Elsevier

St. Louis , Missouri , USA

ISBN: 9780323597081

Binding: Paperback

MEDS12001

Prescribed

Sonography Principles and Instruments E-Book

Edition: 10 (2019)

Authors: Frederick W. Kremkau

Saunders

Philadelphia , PA , USA

ISBN: 0-323-59709-2

Binding: eBook

MEDS12001

Supplementary

Ultrasound physics and technology: how, why and when

Edition: 1 (2009)

Authors: Gibbs, Vivien

Churchill Livingstone Elsevier

Edinburgh , Scotland

ISBN: 9780702030413

Binding: Paperback

Additional Textbook Information

Sonography : principles and instruments by Frederick W. Kremkau is available as an eBook in the CQU library. The entire text can be viewed online, but please note that there is a limit to the number of chapters that may be downloaded.

If you have a copy of Sonography : principles and instruments published prior to Edition 10, the major difference is the introduction of physics principle 2. The chapters relating to this major shift in ultrasound technology can be accessed via the CQU library eBook.

The supplementary text Ultrasound physics and technology: how, why and when is not referred to in lectures, but may a useful resource when revising.

[View textbooks at the CQUniversity Bookshop](#)

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

Deanna Armstrong Unit Coordinator
d.armstrong@cqu.edu.au

Schedule

Week 1- Basic Sonographic Physics Principles - 04 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Back to Basics• Pulse Echo Principle• Sound Wave Parameters• Maths Concepts	Sonography Principles and Instruments, Kremkau 10th edition chapter 1, PP: 1-12, chapter 2, PP 13-44	Tutorial- Wednesday 2:00 pm AEST Physics lab 1: Wednesday for CV69 Friday for CG91

Week 2- Pulsed Ultrasound - 11 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Pulsed Ultrasound• Pulse Repetition Period and Pulse Repetition Frequency• Pulse Duration, Duty Factor and Spatial Pulse Length• Bandwidth	Kremkau Chapter 2, PP 13-44	Tutorial- Wednesday 2:00 pm AEST

Week 3- Sound Interaction with Matter - 18 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Amplitude, Power and Intensity• Attenuation and Absorption• Types of Reflection• Reflection and Acoustic Impedance• Refraction• Ranging	Kremkau Chapter 2, PP 13-44 Ultrasound Physics and Technology, How, Why and When, Gibbs Chapter 4, PP 19-22 Gibbs Chapter 8, PP 45-49	Tutorial- Wednesday 2:00 pm AEST

Week 4- Transducers - 25 Mar 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Transducer Construction• Beam Geometry• The Piezoelectric Effect• Instrumentation	Kremkau Chapter 3, PP 45-63 Kremkau Chapter 4, PP 73-116 Gibbs Chapter 6, PP 27-37	Tutorial- Wednesday 2:00 pm AEST

Week 5- Image Resolution - 01 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• Lateral Resolution• Axial Resolution• Contrast Resolution• Temporal Resolution	Kremkau Chapter 3, PP 63-76 Kremkau Chapter 4, PP 110-116 Gibbs Chapter 7, PP 39-43	Tutorial- Wednesday 2:00 pm AEST Physics lab 2: Thursday for CV6 Friday for CG91

Vacation Week - 08 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
Break week <ul style="list-style-type: none">• No new content		

Week 6- Online Quiz (Mid Term) - 15 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none">• No New Content• Online Quiz (Mid Term)		Online Quiz (Mid term) Due: Week 6 Friday (19 Apr 2024) 11:00 pm AEST

Week 7- Haemodynamics and the Doppler Principle - 22 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
--------------	---------	------------------------------

- Imaging Motion and Flow
- Blood Flow Haemodynamics
- The Doppler Principle
- Colour Doppler

Kremkau Chapter 5, PP 138-162
Gibbs Chapter 11, PP 11-79

Tutorial- Wednesday 2:00 pm AEST

Week 8- Doppler Imaging - 29 Apr 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Doppler Imaging • Spectral Doppler • Power Doppler 	Kremkau Chapter 5, PP 162-189 Gibbs Chapter 11, PP 79-89	Tutorial- Wednesday 2:00 pm AEST

Week 9- Ultrasound Artifacts - 06 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • B-mode Artifacts • Spectral Doppler Artifacts • Colour Doppler Artifacts 	Kremkau Chapter 7, PP 202-235 Gibbs Chapter 9, PP 51-61	Tutorial- Wednesday 2:00 pm AEST

Week 10- Ultrasound Bioeffects - 13 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Thermal and Mechanical Ultrasound Bioeffects • Safety and Quality Assurance • Output Measurements 	Kremkau Chapter 8, PP 236-247 Kremkau Chapter 9, PP 249-258 Gibbs Chapter 12, PP 91-99 Gibbs Chapter 13, PP 101-110	Tutorial- Wednesday 2:00 pm AEST Physics lab 3: Wednesday for CV69 Friday for CG91

Week 11- Additional Modes of Ultrasound Imaging - 20 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • Additional Modes of Ultrasound Imaging • Ultrasound Operating Principle 2 • Sonoelastography • Instruments: Imaging Anatomy, Motion, and Flow 	Kremkau Chapter 4, PP 116-137 Gibbs, Chapter 14, PP 111-119 Kremkau Chapter 6, PP 190-201	Tutorial- Wednesday 2:00 pm AEST Laboratory Manual Submission Due: Week 11 Friday (24 May 2024) 4:30 pm AEST

Week 12- Online Test (End of Term) - 27 May 2024

Module/Topic	Chapter	Events and Submissions/Topic
<ul style="list-style-type: none"> • No New Content • Online Test (End of Term) 		Online test (End of term) Due: Week 12 Friday (31 May 2024) 11:00 pm AEST

Exam Week - 03 Jun 2024

Module/Topic	Chapter	Events and Submissions/Topic
--------------	---------	------------------------------

Exam Week - 10 Jun 2024

Module/Topic	Chapter	Events and Submissions/Topic
--------------	---------	------------------------------

Term Specific Information

The unit coordinator for MEDS12001 is Deanna Armstrong. Deanna is based on the Sydney campus, Monday to Friday. The best way to contact Deanna is via the Q and A forum on the Moodle site. It is important to check the Q and A forum regularly for updates and information about the unit.

If the matter is of a more personal nature email Deanna at d.armstrong@cqu.edu.au ensuring that all email correspondence is via your CQU student email.

Discussions about unit content and assessment are provided in the tutorials. Tutorials are held on Wednesdays at 2:00pm AEST as per the above term schedule. The schedule, links and tutorial recordings are available in the Virtual Classes tile of the Moodle site.

There are three (3) on campus labs to attend during the term in weeks 1, 5 and 10 respectively. Students are expected to perform the tasks set out in their lab manual and answer the relevant questions.

It is highly recommended that students attend these labs as the lab manual submission is a PASS/FAIL assessment of this unit. Failure to submit the lab manual by the due date will result in failing the unit irrespective of student's achievements in other unit assessments.

No replacement labs will be available for students who fail to attend a lab for any reason.

Assessment Tasks

1 Online Quiz (Mid term)

Assessment Type

Online Quiz(zes)

Task Description

You will complete an online quiz to assess your understanding of the concepts delivered in week 1 to week 5 of MEDS12001. The quiz can be accessed through the assessment tab on Moodle.

The online quiz is open from 6:00 am AEST Thursday of Week 6 to 11:00 pm AEST Friday of Week 6.

The questions will be a combination of multiple choice, true or false, gap-fill and drop down selection questions.

Only one quiz attempt is allowed and it cannot be paused or restarted.

Questions will be randomly drawn from a large pool of questions to allow the quiz to be different for each student.

This assessment is to be undertaken as an individual. As with all other university assessments, colluding with other students on non-group work tasks is considered academic misconduct, and may lead to academic penalty.

Number of Quizzes

1

Frequency of Quizzes

Other

Assessment Due Date

Week 6 Friday (19 Apr 2024) 11:00 pm AEST

The online quiz is open from 6:00 am AEST Thursday Week 6 to 11:00 pm AEST Friday Week 6

Return Date to Students

Week 8 Friday (3 May 2024)

The online quiz grades and feedback will be available on Friday in Week 8.

Weighting

40%

Minimum mark or grade

50%

Assessment Criteria

Responses will be assessed according to:

- Knowledge and understanding of physics and ultrasound terminology and concepts,
- Correct interpretation of images/graphs and tables,
- Demonstration of the appropriate use of formulae and correct SI units throughout calculation questions.

Referencing Style

- [Vancouver](#)

Submission

Online

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Ethical practice

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 optimal ultrasound images, with due regard of safe practices

2 Laboratory Manual Submission

Assessment Type

Laboratory/Practical

Task Description

Physics laboratories (labs) will provide an opportunity for you to explore the principles of ultrasound physics and develop knowledge of machine instrumentation and controls under the guidance of a tutor.

In small groups (4-5 people), you will collaboratively perform tasks set out in the lab manual during the practical laboratory sessions (weeks 1, 5 and 10).

During the labs you will work in teams to acquire images and observe the effect of changing machine parameters on the resultant image. Acquired images are to be shared amongst the lab group.

You may complete the lab manual questions during the lab sessions or later in your own time. Lab manual questions are to be answered as an individual.

Upload your completed lab manual to the unit Moodle page via the link provided in the Assessment block.

It is highly recommended that you attend all the laboratory practical sessions in order to meet the unit learning outcomes.

If you do not attend a lab session for any reason you are still required to complete the lab manual exercises and submit the lab manual by the due date.

Please bring a USB stick to labs to save the acquired images.

Please note the following excerpt from the University Assessment of Coursework Procedures: '...students who fail a single assessment task in a pass-fail unit, or who fail a pass-fail component of a graded unit will be deemed to have failed that unit'.

Assessment Due Date

Week 11 Friday (24 May 2024) 4:30 pm AEST

Return Date to Students

Review/Exam Week Friday (7 June 2024)

Weighting

Pass/Fail

Minimum mark or grade

50%

Assessment Criteria

You are required to demonstrate your understanding of each lab task by performing the assigned task and correctly answering the assigned question for each task.

The lab manual questions can be attempted during the lab session, and may be completed in your own time. Questions should be answered concisely and supported by the acquired images where required.

Record and store the acquired images as per instructions in the lab manual. The images are to be stored on a USB drive (provided by the student) and inserted in the lab manual, which should be saved in Microsoft Word format.

This assessment will be marked as a PASS or FAIL. A minimum of fifty percent of the questions must have been answered correctly for students to obtain a PASS grade. A detailed marking rubric is available on unit's Moodle page.

Failure to submit the completed lab manual by the due date and time will result in a grade of "FAIL" for the student regardless of their performance in other assessments of the unit.

There is no option of extension or late submission for the lab manual assessment (unless approved extension is obtained

via the Moodle Extension Request System, with appropriate documentation) as students have 10 weeks to complete this task (from week 1 to week 11 of the term).

Referencing Style

- [Vancouver](#)

Submission

Online

Submission Instructions

The completed lab manual should be submitted as a single Word document .doc or .docx on Moodle.

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Information Technology Competence
- Ethical practice

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 optimal ultrasound images, with due regard of safe practices
- Discuss the principles of ultrasound techniques, Doppler ultrasound and its application in medical ultrasound including safety issues
- Interpret the causes of, and apply problem solving skills to reduce, sources of artifacts on an ultrasound image.

3 Online test (End of term)

Assessment Type

Online Test

Task Description

You will complete an online test to assess your understanding of the concepts delivered in MEDS12001.

The contents of week 1 to week 11 will be assessed in the end of term online test.

The end of term online test will be open from 6:00 am AEST Thursday of week 12 to 11:00 pm AEST Friday of week 12.

The questions will be combination of short answer, calculation, true or false, gap-fill and drop down selection questions.

Questions will be drawn from a pool of questions to allow the test to be different for each student.

This assessment is to be undertaken as an individual. Colluding with other students on non-group work tasks is considered academic misconduct, and may lead to action being taken. Inserting answers from other websites at the time of the online test is considered plagiarism.

Assessment Due Date

Week 12 Friday (31 May 2024) 11:00 pm AEST

The online test is open from 6:00 am AEST Thursday Week 12 to 11:00 pm AEST Friday Week 12.

Return Date to Students

The end of the term online test results will be available on Certification of Grades.

Weighting

60%

Minimum mark or grade

50%

Assessment Criteria

Responses will be assessed according to:

- Demonstration of appropriate and correct interpretation of ultrasound physics using the correct terminology, relevant to image formation, interpretation, clinical practice and patient safety,
- Correct interpretation of images/graphs and tables, with adequate correct explanation of the answer where required,
- Demonstration of correct working out of calculations, including the correct and appropriate use of formulae with correct and appropriate SI units relevant to the physics of ultrasound and its use in the clinical environment,

- Correct written answers, where the question has been comprehensively addressed appropriately in the answer and relevant to the practical and clinical application of the physics of ultrasound.

Referencing Style

- [Vancouver](#)

Submission

Online

Graduate Attributes

- Communication
- Problem Solving
- Critical Thinking
- Ethical practice

Learning Outcomes Assessed

- Apply knowledge of ultrasound physics and practical skills to acquire optimal ultrasound images, with due regard of safe practices
- Discuss the principles of ultrasound techniques, Doppler ultrasound and its application in medical ultrasound including safety issues
- Interpret the causes of, and apply problem solving skills to reduce, sources of artifacts on an ultrasound image.

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