MEDS12001 *Physics of Ultrasound*
Term 1 - 2019

Profile information current as at 14/12/2025 12:39 pm

General Information

Overview
You will be introduced to the principles of ultrasound physics and instrumentation in this unit.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 AND (MEDS11001 Fundamentals of Sonographic Practice OR ECHO11002 Cardiac Structure and Function
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 - 2019

- Brisbane
- Mackay
- Melbourne
- Perth
- 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 Test**
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 unit evaluation

Feedback
Student appreciated timely return of the assessment grades and feedback.

Recommendation
Continue to provide timely detailed feedback via e-mail, Q&A, News Forum and Zoom tutorials.

Feedback from Have your say unit evaluation

Feedback
Students benefited a lot from lectures which were newly prepared and aligned with the new physics textbook. They found the content well covered and the topics explained very clearly.

Recommendation
Continue using prescribed textbook and align lectures with the textbook.

Feedback from Have your say unit evaluation

Feedback
Hands on lab practicals assisted students' learning

Recommendation
The format of labs will continue but the content will be aligned with the lectures covered. The lab manuals will be provided to students in advance.

Feedback from Have your say unit evaluation

Feedback
Students would like an increased word count for the assessment task and a clearer marking rubric.

Recommendation
The assessment task and word limit will be revised. The marking rubric will be designed to clarify the depth of answers expected for each question. A zoom tutorial to explain in detail the requirements of the assessment will be delivered before the deadline for submission.

Feedback from Have your say unit evaluation

Feedback
Students would like longer time allocated to the final exam.

Recommendation
The allocated exam time and the exam questions will be reviewed to ensure sufficient time is allocated to the exam.

Feedback from Have your say unit evaluation

Feedback
Some students found the revised contents for this unit at a higher level than expected.

Recommendation
Introduction of a higher academic rigor in 2018, was designed to benefit the students' understanding of future units in this course. A comprehensive program of teaching at a higher standard in this unit was to reflect the requirements of the ASAR. Students' feedback and results will continue to be monitored as well as the success rates in other units for which this unit is a pre-requisite.

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

— N/A Level • Introductory Level • Intermediate Level • Graduate Level ◦ Professional Level ◦ Advanced Level

Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes				
	1	2	3	4	5
1 - Online Test - 40%		•		•	
2 - Practical Assessment - 0%	•	•	•		•
3 - Examination - 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	•	•	•	•	•

Graduate Attributes	Learning Outcomes				
	1	2	3	4	5
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 Test - 40%	•	•	•			•		•		
2 - Practical Assessment - 0%	•	•	•			•		•		
3 - Examination - 60%	•	•	•					•		

Textbooks and Resources

Textbooks

MEDS12001

Prescribed

Sonography-Principles and Instruments
Edition: NINTH (2016)
Authors: Frederick W. Kremkau
ELSEVIER
St Louis , Missouri , USA
ISBN: 978-0-323-32271-3
Binding: Hardcover
MEDS12001

Supplementary

ULTRASOUND, Physics and Technology, HOW, WHY AND WHEN
Edition: FIRST (2009)
Authors: Vivien Gibbs, David Cole, Antonio Sassano
CHURCHILL LIVINGSTONE ELSEVIER
LONDON , UK
ISBN: 978-0-7020-3041-3
Binding: Hardcover

Additional Textbook Information
Ultrasound by Gibbs is a recommended supplementary book. Students may decide to purchase this book but it is not compulsory.
Either of the above texts can be purchased at the CQUni Bookshop here: http://bookshop.cqu.edu.au (search on the Unit code)

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

Afrooz Najafzadeh Abriz Unit Coordinator
a.najafzadehabriz@cqu.edu.au

Schedule

Week 1- Pulse Echo Principle and Sound Parameters - 11 Mar 2019

Module/Topic	Chapter	Events and Submissions/Topic

Pulse echo principle and sound parameters Back to Basics Pulse Echo Principle Sound Parameters Maths Concepts	Sonography Principles and Instruments, Kremkau Chapter 1, PP: 1-7, chapter 2, PP 13-41	No Zoom tutorial

Week 2- Pulsed Ultrasound and Parameters related to Pulsed Ultrasound - 18 Mar 2019

Module/Topic	Chapter	Events and Submissions/Topic
Pulsed ultrasound and parameters related to pulsed ultrasound Pulsed Ultrasound PRP and PRF PD, DF, SPL, Bandwidth	Kremkau Chapter 2, PP 13-41	Zoom Tutorial Monday 02:00 p.m. AEST

Week 3- Sound interaction with matter - 25 Mar 2019

Module/Topic	Chapter	Events and Submissions/Topic
Sound interaction with matter Amplitude, Power and Intensity Attenuation and Absorption Reflection and Acoustic Impedance Types of Reflection Refraction Ranging	Kremkau Chapter 2, PP 13-41 Ultrasound Physics and Technology, How, Why and When, Gibbs Chapter 4, PP 19-22 Gibbs Chapter 8, PP 45-49	Physics lab one Thursday: 09:00-11:00 (local time) 12:00-14:00 (local time) 14:00-16:00 (local time)

Week 4- Transducers, Beam Geometry and Instrumentation - 01 Apr 2019

Module/Topic	Chapter	Events and Submissions/Topic
Transducers, Beam Geometry and Instrumentation Transducer Construction Beam Geometry Instrumentation	Kremkau Chapter 3, PP 42-59 Kremkau Chapter 4, PP 73-110 Gibbs Chapter 6, PP 27-37	Zoom Tutorial Monday 02:00 p.m. AEST

Week 5, Image Resolution - 08 Apr 2019

Module/Topic	Chapter	Events and Submissions/Topic
Image Resolution Lateral Resolution Axial Resolution Contrast Resolution Temporal Resolution	Kremkau Chapter 3, PP 59-72 Kremkau Chapter 4, PP 106-112 Gibbs Chapter 7, PP 39-43	Physics lab two Thursday 09:00-11:00 (local time) 12:00-14:00 (local time) 14:00-16:00 (local time)

Vacation Week - 15 Apr 2019

Module/Topic	Chapter	Events and Submissions/Topic
This is the break week, please use it to revise for the online test next week.		

Week 6- Revision Week - 22 Apr 2019

Module/Topic	Chapter	Events and Submissions/Topic
No lectures are delivered this week to allow you to concentrate on the online test.		No Zoom tutorial as Easter Monday Online test Tuesday. Access to the online test is available for 10 hours from 09:00-19:00 hours (AEST) **Online Test** Due: Week 6 Tuesday (23 Apr 2019) 7:00 pm AEST

Week 7- Haemodynamics and The Doppler Principle - 29 Apr 2019

Module/Topic	Chapter	Events and Submissions/Topic

Haemodynamics and The Doppler Principle Flow The Doppler Effect	Kremkau Chapter 5, PP 133-142 Gibbs Chapter 11, PP 11-79	Zoom Tutorial Monday 02:00 p.m. AEST

Week 8- Doppler Imaging - 06 May 2019

Module/Topic	Chapter	Events and Submissions/Topic
Doppler Imaging Colour Doppler Displays Spectral Doppler Displays Power Doppler Displays	Kremkau Chapter 5, PP 142-182 Gibbs Chapter 11, PP 79-89	No Zoom tutorial

Week 9- Ultrasound Artifacts - 13 May 2019

Module/Topic	Chapter	Events and Submissions/Topic
Ultrasound Artifacts Propagation Attenuation Spectral Doppler Artifacts Colour Doppler Artifacts	Kremkau Chapter 6, PP 183-216 Gibbs Chapter 9, PP 51-61	Zoom Tutorial Monday 02:00 p.m. AEST

Week 10- Ultrasound Bioeffects - 20 May 2019

Module/Topic	Chapter	Events and Submissions/Topic
Ultrasound Bio-effects Safety and Quality Assurance Performance Measurements Output Measurements Bio-effects Safety	Kremkau Chapter 7, PP 217-239 Gibbs Chapter 12, PP 91-99 Gibbs Chapter 13, 101-110	Physics lab three Thursday 09:00-11:00 (local time) 12:00-14:00 (local time) 14:00-16:00 (local time)

Week 11- Contemporary Imaging - 27 May 2019

Module/Topic	Chapter	Events and Submissions/Topic
Contemporary Imaging: Coded Excitation Harmonic Imaging Panoramic Imaging Spatial Compounding Parallel Processing Elastography	Kremkau Chapter 4, PP 112-118 Gibbs, Chapter 14, PP 111-119	Physics lab manual submission due Friday 02:00 p.m. AEST **The Laboratory Manual Submission.** Due: Week 11 Friday (31 May 2019) 2:00 pm AEST

Week 12- Review and Consolidation - 03 Jun 2019

Module/Topic	Chapter	Events and Submissions/Topic
Review and Consolidation		Pre- exam Zoom Tutorial Monday 02:00 p.m. AEST

Exam Week - 10 Jun 2019

Module/Topic	Chapter	Events and Submissions/Topic
Standard Examination		

Exam Week - 17 Jun 2019

Module/Topic	Chapter	Events and Submissions/Topic
Standard Examination		

Term Specific Information

Access to the internet is required to undertake this unit, as unit materials, tutorials and updates will be provided via Moodle, Zoom and email. It is important to regularly check your student email as updates about the unit will be sent from the unit coordinator via email.
Zoom Tutorials will be held fortnightly on Monday at 02:00 p.m. AEST. These will be recorded for those unable to attend and posted on the unit Moodle page.
Students are expected to spend on average 10-12 hours of time each week in their study activities for this unit. A suggested time budget for weekly study is:

- 2- 2.5 hours for watching recorded lectures and taking notes·
- 1-1.5 hours for completing assigned reading.
- 0.5-1 hour for completing other posted learning activities.
- 2-2.5 hours for creating study notes to meet weekly learning goals using lectures and readings.
- 1-1.5 hours for applying weekly content using posted end-of-chapter questions.
- 0.5 hour for working on posted tutorial questions in preparation for tutorial.
- 1 hour for participation in online tutorial.
- 1-2 hours for assignment preparation for the lab manual and/or revision for the online test and the final examination.

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. Your regular participation strongly supports your success in the unit. While online tutorials will be recorded, these recordings are not intended to replace your active participation in live sessions.
Three (3) physics labs will be held on Thursdays in weeks 3, 5 and 10. Further information about the labs are available on the unit Moodle page under the Assessment Overview section.
The unit co-ordinator for MEDS12001 Term 1, 2019 is Dr Afrooz Najafzadeh Abriz.
The best mode of contact is by e-mail: a.najafzadehabriz@cqu.edu.au
Afrooz's CQU office number is (08) 92604080
Afrooz is based in Perth, so please consider the time difference with the WA when contacting her.

Assessment Tasks

1 Online Test

Assessment Type
Online Test

Task Description
To demonstrate the understanding and knowledge of this unit, students are required to complete an online test. This test can be accessed through the assessment tab on Moodle.
The access to the online test will be available in week 6 on Tuesday 23rd of April 2019.
The contents of week 1 to week 5 will be covered in the online test.
The online test will be open from 09:00 to 19:00 hours on Tuesday 23rd of April. Students based in Western Australia, South Australia, New South Wales and Victoria please be aware of the time difference between your state and AEST.
The test is comprised of ten questions worth 10 marks each.
The questions will be combination of short answer and calculation type questions including image recognition questions. Images included will be from lab activities in week 3 and week 5.
Once the test is accessed, it will remain open for 60 minutes, giving the students an average time of 6 minutes per question.
Questions will be drawn from a pool of questions to allow tests to be different for each student. This assessment is to be undertaken as an individual. As with all other university assessment, 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.
Please note: You MUST start the test before 06:00 pm (AEST) on 23rd of April as the test automatically closes at 07:00 pm (AEST).

Assessment Due Date
Week 6 Tuesday (23 Apr 2019) 7:00 pm AEST

The online test is open for 10.00 hours from 09:00 a.m. (AEST) to 07:00 p.m. (AEST). Once the test is accessed it remains open for 60 minutes. Only one attempt is allowed.

Return Date to Students
Week 8 Friday (10 May 2019)

The online test grades will be available on Moodle by Friday 10th of May 2019 at 02:00 p.m. AEST.

Weighting
40%

Minimum mark or grade
50%

Assessment Criteria
Responses will be assessed according to

- Use of appropriate physics and ultrasound terminology and descriptors as well as grammar, spelling, the relevance of response and competence in addressing all elements of the question.
- The student's ability to appropriately interpret images/graphs/tables and then to succinctly compose an appropriate response based on their learning from the unit.
- Explanations supported by correct physics equations when required with correct units described.
- The student's ability to show all the workout for any calculation question and demonstration of correct methods of using the appropriate formula and use of correct SI unit throughout the calculation.

Referencing Style

- Vancouver

Submission
Online

Submission Instructions
Upon completion of the online test, press submit. The answers will be automatically submitted 60 minutes after the online test is opened.

Learning Outcomes Assessed

- Evaluate the components and performance of diagnostic ultrasound equipment
- Discuss the principles of ultrasound techniques, Doppler ultrasound and its application in medical ultrasound including safety issues

Graduate Attributes

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

2 The Laboratory Manual Submission.

Assessment Type
Practical Assessment

Task Description
The physics labs will provide an opportunity for the students to explore the physical principles of ultrasound and develop their knowledge of machine instrumentation and controls under the guidance of a tutor.
Students are responsible to print their lab manual and bring to the lab or have access to the lab manual on their electronic devices.
In small groups (3-4 people), students are required to collaboratively perform tasks set out in their laboratory (lab) manuals during the practical laboratory sessions (weeks, 3, 5 and 10) and obtain ultrasound images that will assist to answer set questions per task.
During the labs, students will be required to record and store images, and observe the effect of changing machine parameters on the resultant image.
Students will be required to attempts the lab manual questions during the lab sessions. The questions are designed to help students understand the physical properties of ultrasound and how that knowledge is used to inform the practical production of diagnostic medical images.
Students are expected to work in teams to acquire images. Image sharing within lab group members is permitted.

Students are expected to individually submit the completed lab manual by week 11, Friday 31st of May at 14:00 AEST. 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'.
Students will be required to upload their completed lab manual answers to the unit Moodle page via the link provided in the assessment block.
It is a highly recommended component of the unit to attend the laboratory practical sessions in order to meet the learning outcomes. Students who fail to attend a lab for any reason, are still required to complete the lab manual exercises and submit the lab manual by the due date.
Students are advised to bring a USB stick to labs to save the acquired images. Image sharing amongst group members is allowed.

Assessment Due Date
Week 11 Friday (31 May 2019) 2:00 pm AEST

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

Return Date to Students
Week 12 Friday (7 June 2019)

The PASS / FAIL grades will be available on Moodle by Friday 7th of June 2019.

Weighting
Pass/Fail

Minimum mark or grade
50%

Assessment Criteria
Students are required to demonstrate their understanding of each lab task by performing the assigned task correctly and answering the assigned question for each task.
Students are required to record and store the required images as per instructions on the lab manual.
The images are to be stored on a USB drive (provided by the student).
Answering the questions in the lab manual can be attempted during the lab session and may be completed at own time, once the lab activities are completed.
Questions should be answered concisely, supported by the acquired images where required. The acquired images should be inserted in the lab manual which should be saved in the Microsoft Word format.
This assessment will be marked as a PASS or FAIL.
At least fifty percent of the lab activities should have been carried out correctly and the designated questions answered correctly for students to obtain a PASS grade.
Failure to submit the completed lab manual by the due date and time will result in a grade of "FAIL" for the students regardless of their performance in other assessments of the unit.

Referencing Style

- Vancouver

Submission
Online

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
- Interpret the causes of, and apply problem solving skills to reduce, sources of artifacts on an ultrasound image.

Graduate Attributes

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

Examination

Outline
Complete an invigilated examination.

Date
During the examination period at a CQUniversity examination centre.

Weighting
60%

Length
180 minutes

Minimum mark or grade
50

Exam Conditions
Closed Book.

Materials
Dictionary - non-electronic, concise, direct translation only (dictionary must not contain any notes or comments).
Calculator - non-programmable, no text retrieval, silent only

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