MEDS12001 *Physics of Ultrasound*
Term 1 - 2020

Profile information current as at 01/07/2022 02:48 pm

Corrections

Unit Profile Correction added on 30-03-20

The end of term examination has now been changed to an alternate form of assessment. Please see your Moodle site for details of the assessment.

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 - 2020

- 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

Feedback
Students found that the ultrasound physics labs were a fantastic way to learn about this unit in a hands on, practical way.They, however, wished the labs started earlier in the term and extended slightly in duration.

Recommendation
The lab schedules will be reviewed.

Feedback from Have your say

Feedback
Students commented that the weekly summary study notes allowed them to revise easily and concentrate on the main concepts they needed to learn.

Recommendation
Will continue to provide weekly study notes to keep the students focused on the main concepts of each topic.

Feedback from Have your say

Feedback
The sample past exam questions and provided answers throughout the term were commented on as being the most useful learning tool by some of the students

Recommendation
Will continue to provide example past exam questions in weekly contents.

Feedback from Have your say

Feedback
Students liked the two revision weeks incorporated into the unit schedule as it allowed them to revise for the online test and for the final examination.

Recommendation
Will continue the same format of weekly contents to include revision weeks in week 6 and 12 to allow students concentrate on their assessment tasks.

Feedback from Have your say

Feedback
The online test as mid term assessment was well received as it provided feedback on students' performance half way through the term.

Recommendation
Will continue with this mid-term assessment.

Feedback from Have your say

Feedback
Echocardiography students had difficulty contextualising some of the physics to their own profession.

Recommendation
Will include more echocardiography related examples in lectures. Will continue with echo specific lab manuals as this year.

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: 10th (2019)
Authors: Frederick W. Kremkau
ELSEVIER
St Louis , Missouri , U.S.A
ISBN: 9780323597081
Binding: eBook
MEDS12001

Supplementary

ULTRASOUND, Physics and Technology, HOW, WHY AND WHEN
Edition: 1st (2009)
Authors: Vivien Gibbs, David Cole, Antonio Sassano
CHURCHILL LIVINGSTONE ELSEVIER
London , UK
ISBN: 978-0-7020-3041-3
Binding: eBook

Additional Textbook Information
Students who already have a copy of the 9th edition of the text book by Kremkau, do not require to purchase the 10th edition.
If preferred, paper copies are available for purchase 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- Sonography Two Principles of Operation. Operating Principle 1 :Pulse Echo Principle and Sound Parameters - 09 Mar 2020

Module/Topic	Chapter	Events and Submissions/Topic

Sonography: Two Principles of Operation. Back to Basics Pulse Echo Principle Sound Parameters Maths Concepts	Sonography Principles and Instruments, Kremkau 10th edition chapter 1, PP: 1-12, chapter 2, PP 13-44	No Zoom tutorial

Week 2- Pulsed Ultrasound and Parameters related to Pulsed Ultrasound - 16 Mar 2020

Module/Topic	Chapter	Events and Submissions/Topic
Pulsed Ultrasound Pulse Repetition Period and Pulse Repetition Frequency Pulse duration, Duty Factor Spatial Pulse Length Bandwidth	Kremkau Chapter 2, PP 13-44	Zoom Tutorial Monday 02:00 p.m. AEST

Week 3- Sound interaction with matter - 23 Mar 2020

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	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	Physics lab one on Thursday: 09:00-11:00 (local time) 11:30-13:30 (local time) 14:00-16:00 (local time)

Week 4- Transducers, Beam Geometry and Instrumentation - 30 Mar 2020

Module/Topic	Chapter	Events and Submissions/Topic
Transducers, Beam Geometry and Instrumentation Transducer Construction Beam Geometry Instrumentation (Operating Principle 1)	Kremkau Chapter 3, PP 45-63 Kremkau Chapter 4, PP 73-116 Gibbs Chapter 6, PP 27-37	Zoom Tutorial Monday 02:00 p.m. AEST

Week 5, Image Resolution - 06 Apr 2020

Module/Topic	Chapter	Events and Submissions/Topic
Image Resolution 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	Physics lab two on Thursday 09:00-11:00 (local time) 11:30-13:30 (local time) 14:00-16:00 (local time)

Vacation Week - 13 Apr 2020

Module/Topic	Chapter	Events and Submissions/Topic
Break week		

Week 6- Online Test - 20 Apr 2020

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 on Monday as access to the online test is available from Monday 20/04/20 to Tuesday 21/04/20. The online test is accessed using own computers at home. Access to the online test is available for 10 hours from 09:00-19:00 hours (local time for each campus) on Monday 20/04/20 for CG91 students and 09:00 to 19:00 on Tuesday 21/04/20 for CV69 students. **Online Test** Due: Week 6 Tuesday (21 Apr 2020) 7:00 pm AEST

Week 7- Haemodynamics and The Doppler Principle - 27 Apr 2020

Module/Topic	Chapter	Events and Submissions/Topic
Imaging motion and flow with principle 1 Blood flow haemodynamics The Doppler principle Colour Doppler	Kremkau Chapter 5, PP 138-162 Gibbs Chapter 11, PP 11-79	Zoom Tutorial Monday 02:00 p.m. AEST

Week 8- Doppler Imaging - 04 May 2020

Module/Topic	Chapter	Events and Submissions/Topic
Doppler Imaging Spectral Doppler Power Doppler	Kremkau Chapter 5, PP 162-189 Gibbs Chapter 11, PP 79-89	No Zoom tutorial

Week 9- Ultrasound Artifacts - 11 May 2020

Module/Topic	Chapter	Events and Submissions/Topic
Ultrasound Artifacts Propagation Attenuation Spectral Doppler Artifacts Colour Doppler Artifacts	Kremkau Chapter 7, PP 202-235 Gibbs Chapter 9, PP 51-61	Zoom Tutorial Monday 02:00 p.m. AEST

Week 10- Ultrasound Bioeffects - 18 May 2020

Module/Topic	Chapter	Events and Submissions/Topic
Safety and Quality Assurance Performance Measurements Output Measurements Ultrasound Bio-effects	Kremkau Chapter 8, PP 236-247 Kremkau Chapter 9, PP 249-258 Gibbs Chapter 12, PP 91-99 Gibbs Chapter 13, PP 101-110	Physics lab three on Thursday 09:00-11:00 (local time) 11:30-13:30 (local time) 14:00-16:00 (local time)

Week 11- Contemporary Imaging - 25 May 2020

Module/Topic	Chapter	Events and Submissions/Topic
Contemporary Imaging Instruments: Imaging Anatomy, Motion, and Flow with Principle 2	Kremkau Chapter 4, PP 116-137 Gibbs, Chapter 14, PP 111-119 Kremkau Chapter 6, PP 190-201	Physics lab manual submission due Friday 29/05/20 at 02:00 p.m. AEST **The Laboratory Manual Submission.** Due: Week 11 Friday (29 May 2020) 2:00 pm AEST

Week 12- Review and Consolidation - 01 Jun 2020

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

Exam Week - 08 Jun 2020

Module/Topic	Chapter	Events and Submissions/Topic
Standard Examination		

Exam Week - 15 Jun 2020

Module/Topic	Chapter	Events and Submissions/Topic
Standard Examination		

Term Specific Information

Your unit coordinator is Afrooz Najafzadeh Abriz. Afrooz is based in Perth.
The best way to contact Afrooz is by e-mail : a.najafzadehabriz@cqu.edu.au
This term, the access to the online test is available for two days on Monday 20th of April for general sonography students (CG91) and on Tuesday 21st of April for echocardiography students (CV69).
The prescribed book for the unit is Sonography Principles and Instruments 10th edition by Kremkau. If students have a copy of the previous editions, there is no need to purchase the 10th edition as any new material will be covered in lectures.

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 Monday 20th of April for general sonography students enrolled in CG91 and on Tuesday 21st of April for echocardiography students enrolled in CV69.
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 local times on both days.
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 90 minutes, giving the students an average time of 9 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 17:30 local time,as the test automatically closes at 19:00 hours.

Assessment Due Date
Week 6 Tuesday (21 Apr 2020) 7:00 pm AEST
The online test is open from 09:00 to 19:00 (local time) on Monday 20th of April for CG91 students and from 09:00 to 19:00 (local time) for CV69 students

Return Date to Students
Week 8 Friday (8 May 2020)
The online test grades will be available on Moodle by Friday 8th of May 2020 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 working out 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 90 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 for printing their lab manual and bringing to the lab having access to the lab manual on their own electronic devices.
In small groups (4-5 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 29th of May at 14:00 AEST.
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 (29 May 2020) 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 (5 June 2020)
The PASS / FAIL grades will be available on Moodle by Friday 5th of June 2020

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 in the student's own time, once the lab activities are finished.
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. A detailed rubric is available on Moodle.
There is no option of extension or late submission for the lab manual assessment.
Failure to submit the completed lab manual by the due date and time will result in a grade of "FAIL" for the assessment.
Please note the following excerpt from the CQU Assessment Policy and Procedure (Higher Education Coursework), item 4.41: 'Students who fail a single assessment in a pass/fail unit or a pass/fail component in a graded unit will be deemed to have failed that unit, unless the unit profile includes provision for students to re-attempt a failed assessment task and

the student passes the re-attempted assessment'.

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).

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