# HLTH304

## Radiographic Physics, Practice and Protection

S1 Day 2016

*Dept of Chiropractic*

## Contents

# General Information

Unit convenor and teaching staff
Convener
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C5C 347
Tuesday 9am-12pm, Wednesday 1-4pm

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Credit points
3

Prerequisites
39cp including 12cp at 200 level

Corequisites

Co-badged status
CHIR606

Unit description
This unit is conducted to develop students' knowledge in the underlying physical principles of medical radiation science. The unit is presented in three distinct modules: - Module 1 is the study of Radiation Physics, its principles and current technology of imaging equipment. - Module 2 is the study of the principles and practice of image production and image processing techniques. - Module 3 describes the biological effects of radiation as well as current radiation protection techniques.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

# Learning Outcomes

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

Summarise the working principles of x-ray tubes and how these influence their operation and performance

Identify the properties of x-rays and explain how they interact with matter, and influence imaging quality and patient safety

Critically appraise the principles of radiographic image production and processing

Contrast the generation and use of advanced imaging modalities

Explain the biological effects of radiation

Summarise radiation protection in relation to radiography

# General Assessment Information

**TUTORIALS**

Attendance at 3 laboratory sessions across the semester, covering each of the different experiments is compulsory. A missed session must be made up prior to week 13. A timetable will be released early in the semester to inform you which laboratory sessions you should attend.

**ASSIGNMENTS**

Submission of assignments will be through ilearn unless otherwise indicated.

It is expected that the academic honesty policy (http://mq.edu.au/policy/docs/academic_honesty/policy.html) be followed at all times. Breaches of the academic honesty policy may result in disciplinary procedures for the involved student.

References should be cited using the Harvard style of referencing (http://libguides.mq.edu.au/content.php?pid=459099&sid=3759396).

Assignment word limits should be adhered to. A deduction of 10% of the final grade will be applied for every 10% increase in word count above the set limit. Word count does not include

reference lists.

Late submission of assignments will result in a grade deduction of 10% per day late. Submissions handed in more than 1 week after the due date will not be assessed.

Extensions to assessment due dates may be granted under extenuating circumstances. Application for extensions must be made under the disruption to studies policy (http://students.mq.edu.au/student_admin/exams/disruption_to_studies/), applied for through www.ask.mq.edu.au within 5 days of the disruption and prior to the submission date of the assignment. Resubmission of assignments will not be considered under usual circumstances.

**THEORY EXAMINATIONS**

The University Examination period for Semester 1, 2016 is from June 14th to July 1st 2016.

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations.

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for disruption to studies. Information about unavoidable disruption and the disruption to studies process is available athttp://students.mq.edu.au/student_admin/exams/disruption_to_studies/, applied for through www.ask.mq.edu.au within 5 days of the disruption

If a Supplementary Examination is granted the examination will be scheduled after the conclusion of the official examination period.

If you sit the theory exam but successfully apply for disruption from studies for that exam you will be required to sit a supplementary examination. This exam will take the format of short answer questions in a VIVA (oral) exam.

You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is the final day of the official examination period

# Assessment Tasks

| Name | Weighting | Due |
|---|---|---|
| Assignment 1 | 15% | Wednesday 6 April 5pm |
| Laboratory work | 15% | Varies for each prac group |
| Assignment 2 | 20% | Wednesday 11 May 5pm |

| Name | Weighting | Due |
|---|---|---|
| Final Examination | 50% | University Exam period |

## Assignment 1

Due: **Wednesday 6 April 5pm**
Weighting: **15%**

Online quiz covering module 1 (physics); Available on ilearn from Friday 18/3/16

On successful completion you will be able to:

- Summarise the working principles of x-ray tubes and how these influence their operation and performance
- Identify the properties of x-rays and explain how they interact with matter, and influence imaging quality and patient safety

## Laboratory work

Due: **Varies for each prac group**
Weighting: **15%**

3 experiments will be performed across the course of semester starting in week 3 or 4. You will be allocated a group and the timetable of which weeks you are to attend will be posted on ilearn.

On successful completion you will be able to:

- Summarise the working principles of x-ray tubes and how these influence their operation and performance
- Identify the properties of x-rays and explain how they interact with matter, and influence imaging quality and patient safety

## Assignment 2

Due: **Wednesday 11 May 5pm**
Weighting: **20%**

Assignment 2 will be available and submitted through ilearn. It will cover material from module 2. More information regarding this will be available early in the semester.

On successful completion you will be able to:

- Critically appraise the principles of radiographic image production and processing

## Final Examination

Due: **University Exam period**

Weighting: **50%**

Exam material from the whole semester.

A formula sheet will be provided.

Scientific calculators are allowed.

The examined material and exam format will have some differences to previous years. More information regarding this will be made available during the semester.

On successful completion you will be able to:

- Summarise the working principles of x-ray tubes and how these influence their operation and performance
- Identify the properties of x-rays and explain how they interact with matter, and influence imaging quality and patient safety
- Critically appraise the principles of radiographic image production and processing
- Contrast the generation and use of advanced imaging modalities
- Explain the biological effects of radiation
- Summarise radiation protection in relation to radiography

# Delivery and Resources

2-hour lectures each week on Friday 10am-12pm in E7BT4 and 3 x 3-hour practical laboratory's per student as scheduled.

The web page for this unit can be found at: https://ilearn.mq.edu.au and following the links for either Postgraduate or Undergraduate students

**REQUIRED TEXTS/MANUALS**

Radiological Science For Technologists - Physics, Biology and Protection. - Stewart C Bushong 10th Edition, Elsevier, 2013.

HLTH304/CHIR606 Laboratory Notebook 2016 – available from Co-op book store.

**REFERENCES**

Essentials of Radiologic Science. - Robert A. Fosbinder & Denise Orth; Philadelphia : Wolters Kluwer Health/Lippincott Williams & Wilkins. 2010

Principles of Radiological Physics. - Robin Wilks, (2nd Edition), Churchill Livingstone Edinburgh. 1987

Introduction to Radiologic Technology. - LaVerne Tolley Gurley & William J. Callaway (7th Edition); Mosby  St Louis 2011

# Unit Schedule

**WEEK 1 Rich Mildren/Hazel Jenkins**

Introduction. Electricity and magnetism/Explanation of syllabus. Historical background and the current use of radiography.

**WEEK 2/3 Rich Mildren**

Electric currents. Electromagnetic radiation. X-ray circuits. X-ray tubes. What are X-rays and how are they produced.

**WEEK 4 NO LECTURE: PUBLIC HOLIDAY**

**WEEK 5 Rich Mildren/Hazel Jenkins**

X-ray interactions./Image formation. Optical Density and Contrast as related to exposure parameters: milliamperes (mA),time (s), milliampere seconds (mAs), Kilovoltage (kVp), distance (SID or FFD).

**WEEK 6 Hazel Jenkins**

Scatter radiation. Grids. Image sharpness. Assessing the image.

**WEEK 7 Anthony Buxton**

Radiographic film. Film processing. Sensitometry & densitometry. Characteristic curve. Intensifying screens – Construction; Spectral matching; Screen speed; Quantum mottle Film/ screen cassettes;

**WEEK 8 Anthony Buxton**

Direct Radiography, Computed Radiography, Radiological Information Systems (RIS) and Picture Archival and Communication Systems (PACS). Digital Image manipulation – Window and Level (Density and Contrast). Exposure Indices.

**WEEK 9 Anthony Buxton**

Variable kVp techniques. Automatic Exposure Control (AEC). Image artifacts.

**WEEK 10 Anthony Buxton**

Special radiographic equipment (Fluoroscopy, CT, MRI).

**WEEK 11 Subra Vemulpad**

Biological effects of radiation. The Law of Bergonne & Tribondeau. Linear energy transfer. Types of cell damage.

**WEEK 12 Subra Vemulpad**

Direct & indirect effects. High-dose radiation effects. Radiation & pregnancy. Genetic effects.

**WEEK 13 Anthony Buxton**

Radiation protection. Reduction of radiation dose to the patient. Reduction of radiation exposure

to the staff. Effective dose. Regulations. Radiation detectors. Natural background radiation.

# Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central. Students should be aware of the following policies in particular with regard to Learning and Teaching:

Academic Honesty Policy http://mq.edu.au/policy/docs/academic_honesty/policy.html

**New Assessment Policy in effect from Session 2 2016** http://mq.edu.au/policy/docs/assessment/policy_2016.html. For more information visit http://students.mq.edu.au/events/2016/07/19/new_assessment_policy_in_place_from_session_2/

Assessment Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/assessment/policy.html

Grading Policy prior to Session 2 2016 http://mq.edu.au/policy/docs/grading/policy.html

Grade Appeal Policy http://mq.edu.au/policy/docs/gradeappeal/policy.html

Complaint Management Procedure for Students and Members of the Public http://www.mq.edu.au/policy/docs/complaint_management/procedure.html

Disruption to Studies Policy http://www.mq.edu.au/policy/docs/disruption_studies/policy.html *The Disruption to Studies Policy is effective from March 3 2014 and replaces the Special Consideration Policy.*

In addition, a number of other policies can be found in the Learning and Teaching Category of Policy Central.

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/support/student_conduct/

## Results

Results shown in *iLearn*, or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit ask.mq.edu.au.

# Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

## Learning Skills

Learning Skills (mq.edu.au/learningskills) provides academic writing resources and study strategies to improve your marks and take control of your study.

- Workshops
- StudyWise
- Academic Integrity Module for Students

- Ask a Learning Adviser

## Student Services and Support

Students with a disability are encouraged to contact the Disability Service who can provide appropriate help with any issues that arise during their studies.

## Student Enquiries

For all student enquiries, visit Student Connect at ask.mq.edu.au

## IT Help

For help with University computer systems and technology, visit http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

# Graduate Capabilities

## Capable of Professional and Personal Judgement and Initiative

We want our graduates to have emotional intelligence and sound interpersonal skills and to demonstrate discernment and common sense in their professional and personal judgement. They will exercise initiative as needed. They will be capable of risk assessment, and be able to handle ambiguity and complexity, enabling them to be adaptable in diverse and changing environments.

This graduate capability is supported by:

### Learning outcomes

- Critically appraise the principles of radiographic image production and processing
- Summarise radiation protection in relation to radiography

### Assessment tasks

- Assignment 2
- Final Examination

## Commitment to Continuous Learning

Our graduates will have enquiring minds and a literate curiosity which will lead them to pursue knowledge for its own sake. They will continue to pursue learning in their careers and as they participate in the world. They will be capable of reflecting on their experiences and relationships with others and the environment, learning from them, and growing - personally, professionally and socially.

This graduate capability is supported by:

## Learning outcomes

- Critically appraise the principles of radiographic image production and processing
- Summarise radiation protection in relation to radiography

## Assessment tasks

- Assignment 2
- Final Examination

# Discipline Specific Knowledge and Skills

Our graduates will take with them the intellectual development, depth and breadth of knowledge, scholarly understanding, and specific subject content in their chosen fields to make them competent and confident in their subject or profession. They will be able to demonstrate, where relevant, professional technical competence and meet professional standards. They will be able to articulate the structure of knowledge of their discipline, be able to adapt discipline-specific knowledge to novel situations, and be able to contribute from their discipline to inter-disciplinary solutions to problems.

This graduate capability is supported by:

## Learning outcomes

- Summarise the working principles of x-ray tubes and how these influence their operation and performance
- Identify the properties of x-rays and explain how they interact with matter, and influence imaging quality and patient safety
- Critically appraise the principles of radiographic image production and processing
- Contrast the generation and use of advanced imaging modalities
- Explain the biological effects of radiation
- Summarise radiation protection in relation to radiography

## Assessment tasks

- Assignment 1
- Laboratory work
- Assignment 2
- Final Examination

# Critical, Analytical and Integrative Thinking

We want our graduates to be capable of reasoning, questioning and analysing, and to integrate and synthesise learning and knowledge from a range of sources and environments; to be able to critique constraints, assumptions and limitations; to be able to think independently and systemically in relation to scholarly activity, in the workplace, and in the world. We want them to

have a level of scientific and information technology literacy.

This graduate capability is supported by:

### Learning outcomes

- Summarise the working principles of x-ray tubes and how these influence their operation and performance
- Identify the properties of x-rays and explain how they interact with matter, and influence imaging quality and patient safety
- Critically appraise the principles of radiographic image production and processing
- Contrast the generation and use of advanced imaging modalities
- Explain the biological effects of radiation
- Summarise radiation protection in relation to radiography

### Assessment tasks

- Assignment 1
- Laboratory work
- Assignment 2
- Final Examination

## Problem Solving and Research Capability

Our graduates should be capable of researching; of analysing, and interpreting and assessing data and information in various forms; of drawing connections across fields of knowledge; and they should be able to relate their knowledge to complex situations at work or in the world, in order to diagnose and solve problems. We want them to have the confidence to take the initiative in doing so, within an awareness of their own limitations.

This graduate capability is supported by:

### Learning outcomes

- Critically appraise the principles of radiographic image production and processing
- Summarise radiation protection in relation to radiography

### Assessment tasks

- Assignment 2
- Final Examination

## Effective Communication

We want to develop in our students the ability to communicate and convey their views in forms effective with different audiences. We want our graduates to take with them the capability to read, listen, question, gather and evaluate information resources in a variety of formats, assess, write clearly, speak effectively, and to use visual communication and communication

technologies as appropriate.

This graduate capability is supported by:

### Learning outcome

- Summarise radiation protection in relation to radiography

### Assessment task

- Final Examination

## Engaged and Ethical Local and Global citizens

As local citizens our graduates will be aware of indigenous perspectives and of the nation's historical context. They will be engaged with the challenges of contemporary society and with knowledge and ideas. We want our graduates to have respect for diversity, to be open-minded, sensitive to others and inclusive, and to be open to other cultures and perspectives: they should have a level of cultural literacy. Our graduates should be aware of disadvantage and social justice, and be willing to participate to help create a wiser and better society.

This graduate capability is supported by:

### Learning outcomes

- Explain the biological effects of radiation
- Summarise radiation protection in relation to radiography

### Assessment task

- Final Examination

## Socially and Environmentally Active and Responsible

We want our graduates to be aware of and have respect for self and others; to be able to work with others as a leader and a team player; to have a sense of connectedness with others and country; and to have a sense of mutual obligation. Our graduates should be informed and active participants in moving society towards sustainability.

This graduate capability is supported by:

### Learning outcomes

- Explain the biological effects of radiation
- Summarise radiation protection in relation to radiography

### Assessment task

- Final Examination

# Changes from Previous Offering

There is no longer a mid-semester exam and the physics material will now be included in the

final examination in the formal examination period. Please be aware of this change when looking at past exam examples as there will be no physics questions included in the past exams.

# Disruption from Studies Policy

**Serious and unavoidable disruption:** The University classifies a disruption as **serious and unavoidable** if it:

- could not have reasonably been anticipated, avoided or guarded against by the student; and
- was beyond the student's control; and
- caused substantial disruption to the student's capacity for effective study and/or completion of required work; and
- occurred during an event critical study period and was at least three (3) consecutive days duration, and/or
- prevented completion of a final examination.

Students with a pre-existing disability/health condition or prolonged adverse circumstances may be eligible for ongoing assistance and support. Such support is governed by other policies and may be sought and coordinated through Campus Wellbeing and Support Services.

If a supplementary examination is granted as a result of the disruption to studies process the examination will be scheduled after the conclusion of the official examination period. (Individual Faculties may wish to signal when the Faculty Supplementary exams are normally scheduled.)

***If you are granted a supplementary exam via the Disruption to Studies process, you will have to write a supplementary exam in the supplementary exam period. In this scenario, only your supplementary exam mark will count towards your final exam mark, irrespective of whether or not you attended the final exam in the normal examination period. The submission of a Disruption to Studies form should not be used as a 'just in case' strategy.***

You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. You are expected to ensure that you are available until the end of the teaching semester that is the final day of the official examination period.

# Changes since First Published

| Date | Description |
|---|---|
| 26/02/2016 | Changed lecture room location |
| 16/02/2016 | Change to wording of learning outcomes 1 and 2 |