HLTH314

Radiographic Physics, Practice and Protection

S1 Day 2019

Dept of Chiropractic

Contents

Disclaimer

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General Information

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Credit points
3

Prerequisites
39cp at 100 level or above including 12cp at 200 level

Corequisites

Co-badged status

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 image 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

LABORATORIES

You will be scheduled to attend 3 laboratory sessions throughout the semester. 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. Please email the lab manager, Adam Joyce adam.joyce@mq.edu.au if you have concerns regarding your laboratory session time or to arrange making-up missed sessions.

IN-CLASS EXAMS

If an in-class exam is missed a supplementary exam will only be considered under the Special Consideration policy (https://students.mq.edu.au/study/my-study-program/special-consideration), applied for through www.ask.mq.edu.au within 5 days of the assessment.

Attendance at an in-class exam declares that you are fit to sit the exam. Re-sitting of in-class exams will only be considered under the Special Consideration policy (https://students.mq.edu.au/study/my-study-program/special-consideration), applied for through www.ask.mq.edu.au within 5 days of the assessment. If a re-sit occurs, either a VIVA

(oral) or written format may be used.

THEORY EXAMINATIONS

The University Examination period for Semester 1, 2019 is from June 11th to June 28th 2019.

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.

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.

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 Special Consideration. Information about unavoidable disruption and the Special Consideration process is available at https://students.mq.edu.au/study/my-study-program/special-consideration, applied for through www.ask.mq.edu.au within 5 days of the disruption

If you receive special consideration for the final exam, a supplementary exam will be scheduled in the interval between the 15th to 26th July. By making a special consideration application for the final exam you are declaring yourself available for a resit during the supplementary examination period and will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. You can check the supplementary exam information page on FSE101 in iLearn (bit.ly/FSESupp) for dates, and approved applicants will receive an individual notification one week prior to the exam with the exact date and time of their supplementary examination. If you are approved for Special Consideration and granted a supplementary exam, only your supplementary exam result will be counted towards your final grade.

If you attend and complete an examination you are declaring that you are fit to sit that assessment and Special Consideration will not normally be granted.

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.

Assessment Tasks

Name	Weighting	Hurdle	Due
In-class exam 1	20%	No	Week 7 or87
Laboratory work	10%	No	Varies for each group
In-class exam 2	20%	No	Week 11 or 12
Final Examination	50%	No	University Exam period

In-class exam 1

Due: **Week 7 or87**
Weighting: **20%**

An in-class exam on material covered lecture and tutorial sessions on physics will occur in the 3rd tutorial (week 7 or 8 depending on your allocated group)

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 image quality and patient safety

Laboratory work

Due: **Varies for each group**
Weighting: **10%**

3 experiments will be performed across the course of semester starting in week 3. 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 image quality and patient safety

In-class exam 2

Due: **Week 11 or 12**
Weighting: **20%**

An in-class exam on material covered in lectures and tutorial sessions on image formation will occur in the 5th tutorial (week 11 or 12 depending on your allocated group)

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%**

The exam will assess material from the whole semester.

A formula sheet will be provided.

Scientific calculators are allowed.

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 image 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

LECTURES

2-hour lectures each week on Tuesday 4-6pm in 14 S.C.O Ave Mason Theatre. These lectures are also available on ilearn.

LABORATORY SESSIONS

3 x 3-hour practical laboratory's per student as scheduled, starting week 3. You will be divided into separate groups and wlll attend the appropriate weeks as indicated on the laboratory schedule, available on the unit ilearn page.

TUTORIAL SESSIONS

5 x 1-hour tutorial sessions per student as scheduled. You will be divided into separate groups and attend alternate weeks starting week 3.

iLEARN PAGE

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. There is a combined ilearn page for HLTH314 and CHIR606 students.

REQUIRED TEXTS/MANUALS

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

HLTH314/CHIR606 Laboratory Notebook 2019 – 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 Hazel Jenkins

Historical background and the current use of radiography. 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 2 Rich Mildren

Electricity and magnetism/Explanation of syllabus.

WEEK 3 Rich Mildren

Electric currents. Electromagnetic radiation. X-ray circuits. X-ray tubes.

WEEK 4 Rich Mildren

What are X-rays and how are they produced. X-ray interactions.

WEEK 5 Hazel Jenkins

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

WEEK 6 Tony Buxton

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

WEEK 7 Tony 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 8 Tony Buxton

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

WEEK 9 Tony Buxton

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

WEEK 10 Tony Buxton (pre-recorded lecture only)

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

WEEK 11 Tony Buxton (pre-recorded lecture only)

Radiation protection. Reduction of radiation dose to the patient. Reduction of radiation exposure to the staff. Effective dose. Regulations. Radiation detectors. Natural background radiation.

WEEK 12 Tony Buxton (pre-recorded lecture only)

Special radiographic equipment (Fluoroscopy, CT, MRI).

WEEK 13 No lecture

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/policy-central). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy
- Fitness to Practice Procedure
- Grade Appeal Policy
- Complaint Management Procedure for Students and Members of the Public
- Special Consideration Policy *(**Note:** The Special Consideration Policy is effective from 4 December 2017 and replaces the Disruption to Studies Policy.)*

Undergraduate students seeking more policy resources can visit the Student Policy Gateway (https://students.mq.edu.au/support/study/student-policy-gateway). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

If you would like to see all the policies relevant to Learning and Teaching visit Policy Central (https://staff.mq.edu.au/work/strategy-planning-and-governance/university-policies-and-procedures/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/study/getting-started/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) 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 or if you are a Global MBA student contact globalmba.support@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

If you are a Global MBA student contact globalmba.support@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
- Contrast the generation and use of advanced imaging modalities

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

Assessment tasks

- In-class exam 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

- In-class exam 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 image quality and patient safety
- Critically appraise the principles of radiographic image production and processing
- Contrast the generation and use of advanced imaging modalities

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- Summarise radiation protection in relation to radiography

Assessment tasks

- In-class exam 1
- Laboratory work
- In-class exam 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 image quality and patient safety
- Critically appraise the principles of radiographic image production and processing
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Assessment tasks

- In-class exam 1
- Laboratory work
- In-class exam 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

- In-class exam 2
- 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

- Contrast the generation and use of advanced imaging modalities
- 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

- Contrast the generation and use of advanced imaging modalities
- Explain the biological effects of radiation
- Summarise radiation protection in relation to radiography

Assessment task

- Final Examination

Changes from Previous Offering

No changes from previous offerings

Changes since First Published

Date	Description
25/02/2019	Corrected dates for in-class exams