Module Specification

Magnetic Resonance Imaging Technology

Version: 2023-24, v2.0, 21 Jul 2023

Contents

Part 1: Information

Module title: Magnetic Resonance Imaging Technology

Module code: UZYY4Q-15-M

Level: Level 7

For implementation from: 2023-24

UWE credit rating: 15

ECTS credit rating: 7.5

Faculty: Faculty of Health & Applied Sciences

Department: HAS School of Health and Social Wellbeing

Partner institutions: None

Field: Allied Health Professions

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: This distance learning module aims to provide students with the necessary knowledge of the core physical principles, instrumentation and quality assurance of Magnetic Resonance Imaging (MRI). This will enable students to apply this knowledge clinically in a safe and appropriate manner that offers a quality service to patients.

Features: Module Entry Requirements: Radiography professional qualification or relevant clinical Magnetic Resonance Imaging (MRI) experience

Educational aims: See learning outcomes.

Outline syllabus: The syllabus will include:

Nuclear Resonance:

properties of hydrogen nuclei: spin, precession, Larmor frequency
net magnetization
nuclear magnetic resonance
Radiofrequency excitation and signal detection
Chemical Shift
Free Induction Decay
relaxation mechanisms
stages of a Spin-echo sequence
K-space
Relationship between TR and TE for T1W T2W and PD contrast
Basics of contrast in relation to tissue type

Spatial Encoding:

The effect of bipolar gradients on the magnetic field, precession frequency and spin phase
The stages of spatial encoding in 2D and 3D imaging
The relationship between amplitude, gradient application time and dephasing
Similarities and differences between frequency spatial encoding and phase encoding
Advantages and disadvantages of 3D imaging
Look at the relationship between spatial encoding and the notion of spatial frequency

Pulse Sequences – parameters and relationships to anatomical and pathological appearances:

Spin Echo sequences
Gradient echo sequences
Echo planar Imaging sequences

Magnetization-prepared sequences

Signal suppression techniques:

Spatial presaturation
Magnetization transfer suppression
Frequency selective saturation

Instrumentation and safety:

Types of main magnet, their advantages and drawbacks
The cryogen – its role, temperature maintenance and safety implications (quench)
Specifications and performance of a magnetic field gradient
Acoustic noise
The components of the radiofrequency channel and the different types of antenna
Projectile and eddy current effects
Materials at risk and the precautions prior to an MRI examination
Peripheral nerve stimulation during an MRI examination
Factors affecting SAR and how to reduce it

Image quality and artefacts

Quality Assurance

Improving contrast:

Magnetisation transfer
Fat Saturation
STIR
Contrast agents

Parallel acquisition methods

The module will be delivered online via a Virtual Learning Environment (VLE) which

will be a wiki. The teaching and learning strategy will embrace a series of vodcasts and enquiry-based learning activities presented via the VLE. Students will engage in knowledge construction, peer learning and social constructivism through work on the wiki.

The wiki will provide a medium for tutor facilitation and formative feedback/feedforward.

Part 3: Teaching and learning methods

Teaching and learning methods: Scheduled learning To include planned synchronous discussion board activity and tutorial support.

Independent learning To include keynote lectures, presented as recordings or vodcasts, wiki facilitation by subject area experts, essential reading, wiki writing, group work, assessment preparation.

Additional student support will be available via telephone, e-mail and Skype.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Demonstrate a systematic understanding of the core physical principles of Magnetic Resonance Imaging (MRI) and the general relationships between anatomy, pathology and image appearances

MO2 Demonstrate an in depth understanding of MRI safety, legislation and guidelines and how to apply these appropriately in a clinical setting

MO3 Critically evaluate the technical quality of MR images to determine errors and determine remedial action

MO4 Critically analyse a range of image reformatting and post processing technologies

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 141 hours

Face-to-face learning = 9 hours

Total = 150

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/index.html

Part 4: Assessment

Assessment strategy: Summative Assessment Task: Individual contribution to a wiki.

Rationale: Working in groups, students will write a Wiki throughout the run of the module. The wiki will be themed on the learning outcomes and draw from lecture/ vodcast content and material from independent study. Grades will reflect individual contribution and academic performance. The creation of the wiki is very much a learning process and therefore this component of assessment takes an assessment for learning approach. The wiki will be facilitated by a tutor who will be able to provide formative feedback/feedforward.

Assessment tasks:

Online Assignment (First Sit)
Description: Individual contribution to a wiki
Weighting: 100 %
Final assessment: Yes
Group work: Yes
Learning outcomes tested: MO1, MO2, MO3, MO4

Online Assignment (Resit)
Description: Individual contribution to a wiki
Weighting: 100 %

Final assessment: Yes

Group work: No

Learning outcomes tested: MO1, MO2, MO3, MO4

Part 5: Contributes towards

This module contributes towards the following programmes of study: