

EUtempe-RX MPE07: Optimisation of X-ray imaging using standard and innovative techniques

Module aims and outcomes

Aim: This module aims to help the future MPE (Diagnostic Radiology) acquire the knowledge, skills and competences necessary to:

1. measure modulation transfer function (MTF), noise power spectra (NPS) and detective quantum efficiency (DQE)
2. undertake optimisation of planar imaging systems in general radiographic and mammographic systems.

The optimisation techniques discussed will include standard test object measurements of image quality and advanced quantitative measurements.

Learning outcomes

Able to:

1. Discuss in detail image quality metrics such as MTF, NPS and DQE.
2. Evaluate the performance of a detector using quantitative techniques such as MTF and DQE.
3. Discuss how the results of quantitative measurements relate to the image quality of a system.
4. Take responsibility for improving the quality of radiological examinations.
5. Undertake research on the optimisation of clinical systems.
6. Implement the results of an optimisation study in a clinical department.
7. Design and implement an optimisation study using clinical images.
8. Discuss the methods for observer studies such as alternative forced choice (AFC), receiver operating curves (ROC), free-response ROC (FROC) and explain the strengths and weaknesses of each method.
9. Discuss the role of the MPE in optimising image quality and dose in a radiology department.

Part 1: e-learning course

Course will be online from June 2017

The majority of the course will be undertaken online. The course will consist of screencasts, videos and interactive content. There will also be video conferencing and an online forum. Online course requires 60 hours.

Option: Online only for whole course (NEW)

Online course content

Introductory concepts

- Definition of optimisation
- Mathematical concepts such as Fourier transforms
- Designs of radiographic detectors

Quantitative measurements

- Beam quality
- Understanding and measuring of MTF, NPS and DQE
- Use of quantitative measurements

Optimisation techniques

- Patient dosimetry and radiation risk
- Optimising systems using quantitative measurements
 - Contrast to noise ratio (CNR)
 - Contrast detail test objects
- Applying results of optimisation study in clinical department

Clinical optimisation techniques

- Understanding the clinical task
- Obtaining clinical images
- Use of anthropomorphic phantoms
- Lesion simulation
- Quantification of clinical image quality
- Adapting image quality of clinical images
- Types of observer studies
- Analysing observer study data: ROC, FROC, AFC, JAFROC

Pre-requisite experience: The participants should be familiar with the standard quality control methods for general radiography and/or mammography systems.

Part 2: Face to face course

Monday 9th to Wed. 11rd October 2017

Education Centre,
Royal Surrey County Hospital,
Guildford, GU2 7XX UK

The course will consist of seminars and practicals. There will be opportunities to talk with experts in quantitative measurements, optimisation and observer studies.

Participants **must**:

- complete the online part of the course before the face-to-face meeting.
- take a laptop to course

Fees

Course: £580 (subsidised £300) includes teas, coffees breaks;

Online only: £440 (subsidised £240)

Fee for lunches subsidised £4 per day

Course dinner: £25.

The participants will meet the cost of travel, accommodation and other meals.

Travel

Guildford is an old market town south west of London, with regular fast trains from central London (Waterloo station).

London Gatwick is the closest airport with direct trains to Guildford. **London Heathrow** is linked to Guildford by bus. **London City, Luton & Stansted airports** are not close, participants would need to travel via central London.

There are regular **Eurostar trains** from Paris Lille, and Brussels to central London (St Pancras station).

Electrical Sockets: Remember to bring a Europe to UK socket adapter for your laptop



Face to face course content

Will be covered in online only course

Seminars

- Clinical image quality by a radiologist
- Quantitative measurements
- Adaption of images
- Optimisation using quantitative techniques
- Observer study methodologies

Practicals

- Calculation of MTF, NPS and DQE
- Undertake an observer study
- JAFROC analysis

Assessment:

Quantitative measurements: 2 hour written paper on Tuesday 10th October.

Optimisation: Post course assignment
Certificates issued for pass.

Food

Course dinner: 10th October at a traditional old English restaurant.



Guildford also has a wide range of restaurants and cafes for the other nights.

Suggested accommodation

Travelodge, 2.5 km; from £34 per night (www.travelodge.co.uk/hotels/287/Guildford-hotel)

Holiday inn, 1 km; from £120 per night (www.holidayinn.com)

Little Gables Bed and Breakfast 1.5 km (on foot, through woods); from £65 per night (www.littlegablesguildford.co.uk)



Weather

Average high temperatures of 15°C in October.

Tourist information: Vibrant shopping area, beautiful Surrey Hills in Autumn colours, Guildford Castle and Cathedral, easy access to London.

Further course information:

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