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 2019

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 a online forum. Online course requires 60 hours.

Online only Option

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

Mon. 14th to Wed. 16th October 2019

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

Face to face course content

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
- Optimisation study using CNR
- Undertake an observer study
- JAFROC analysis

Assessment:

Quantitative measurements: 2-hour written papers on Wed 16th 14th October.
Optimisation: Post course assignment
Participants who pass the exam will receive certificates and EBAMP CPD

Costs

Course: £630 (Subsidised £330) includes teas, coffee breaks;
Online only £450 (subsidised (£250)
Fee for lunches subsidised £4 per day
Course dinner £25.
The participants will meet the cost of travel, accommodation and other meals.

Food

Course dinner: 14th October at a traditional old English restaurant.

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

Travel

Guildford is an old market town located to the south west of London. There are regular fast trains from central London (Waterloo station) to Guildford.

London Gatwick is the closest airport with direct trains to Guildford. **London Heathrow** is linked to Guildford by bus. **London City, Luton and Stansted airports** are not close, participants would need to travel via central London.
There are regular **Eurostar trains** from Paris and Brussels to central London (St Pancras station).

Suggested accommodation

Holiday inn, 1 km; from £287
For 3 nights (www.holidayinn.com)

Travelodge, 2.5 km; from £140 for 3 nights (www.travelodge.co.uk/hotels/287/Guildford-hotel)

Weather

Average high temperatures of 15˚C in October.

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

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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