EUTEMPE-RX

combining e-learning and face-to-face training to build expert knowledge, skills and competences for medical physicists in radiology

Hilde Bosmans

AAPM Annual Meeting 2016, Washington
EUTEMPE-RX
EUropean Teaching and Education for Medical Physics Experts in RX

www.eutempe-RX.eu
Overview

- History
- EUTEMPE-RX methods
- Quality
- Sustainability
- A warm welcome to all of you!
I

(Resolutions, recommendations and opinions)

RECOMMENDATIONS

EUROPEAN PARLIAMENT

COUNCIL

RECOMMENDATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 23 April 2008
on the establishment of the European Qualifications Framework for lifelong learning

(Text with EEA relevance)

(2008/C 111/01)
## ANNEX II

Descriptors defining levels in the European Qualifications Framework (EQF)

Each of the 8 levels is defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system of qualifications.

<table>
<thead>
<tr>
<th>Level</th>
<th>The learning outcomes relevant to Level</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The learning outcomes relevant to Level 1 are</td>
<td>basic general knowledge</td>
<td>basic skills required to carry out simple tasks</td>
<td>work or study under direct supervision in a structured context</td>
</tr>
<tr>
<td>2</td>
<td>The learning outcomes relevant to Level 2 are</td>
<td>basic factual knowledge of a field of work or study</td>
<td>basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools</td>
<td>work or study under supervision with some autonomy</td>
</tr>
<tr>
<td>3</td>
<td>The learning outcomes relevant to Level 3 are</td>
<td>knowledge of facts, principles, processes and general concepts, in a field of work or study</td>
<td>a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information</td>
<td>take responsibility for completion of tasks in work or study adapt own behaviour to circumstances in solving problems</td>
</tr>
<tr>
<td>4</td>
<td>The learning outcomes relevant to Level 4 are</td>
<td>factual and theoretical knowledge in broad contexts within a field of work or study</td>
<td>a range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study</td>
<td>exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities</td>
</tr>
<tr>
<td>5 (*)</td>
<td>The learning outcomes relevant to Level 5 are</td>
<td>comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge</td>
<td>a comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems</td>
<td>exercise management and supervision in contexts of work or study activities where there is unpredictable change review and develop performance of self and others</td>
</tr>
<tr>
<td>Level 6 (**)</td>
<td><strong>The learning outcomes relevant to Level 6 are</strong></td>
<td><strong>advanced knowledge of a field of work or study, involving a critical understanding of theories and principles</strong></td>
<td><strong>advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study</strong></td>
<td><strong>manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts</strong></td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td><strong>Level 7 (</strong>*)**</td>
<td><strong>The learning outcomes relevant to Level 7 are</strong></td>
<td><strong>highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and for research</strong></td>
<td><strong>specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields</strong></td>
<td><strong>manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches</strong></td>
</tr>
<tr>
<td><strong>Level 8 (****)</strong></td>
<td><strong>The learning outcomes relevant to Level 8 are</strong></td>
<td><strong>knowledge at the most advanced frontier of a field of work or study and at the interface between fields</strong></td>
<td><strong>the most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice</strong></td>
<td><strong>demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts</strong></td>
</tr>
</tbody>
</table>

**Compatibility with the Framework for Qualifications of the European Higher Education Area**

The Framework for Qualifications of the European Higher Education Area provides descriptors for cycles. Each cycle descriptor offers a generic statement of typical expectations of achievements and abilities associated with qualifications that represent the end of that cycle.

(* *) The descriptor for the first cycle in the Framework for Qualifications of the European Higher Education Area agreed by the ministers responsible for higher education at their meeting in Bergen in May 2005 in the framework of the Bologna process corresponds to the learning outcomes for EQF level 5.

(**) The descriptor for the higher education short cycle (within or linked to the first cycle, developed by the Joint Quality Initiative as part of the Bologna process, corresponds to the learning outcomes for EQF level 5.

(***) The descriptor for the second cycle in the Framework for Qualifications of the European Higher Education Area agreed by the ministers responsible for higher education at their meeting in Bergen in May 2005 in the framework of the Bologna process corresponds to the learning outcomes for EQF level 7.

(****) The descriptor for the third cycle in the Framework for Qualifications of the European Higher Education Area agreed by the ministers responsible for higher education at their meeting in Bergen in May 2005 in the framework of the Bologna process corresponds to the learning outcomes for EQF level 8.
How we got started (2)
Qualification Framework for the Medical Physics Expert (MPE) in Europe

MPE: “An individual having the knowledge, training and experience to act or give advice on matters relating to radiation physics applied to medical exposure, whose competence to act is recognized by the Competent Authorities” (Revised BSS)

The Qualifications Framework is based on the European Qualifications Framework (EQF). In the EQF learning outcomes are defined in terms of Knowledge, Skills, Competences (KSC) (European Parliament and Council 2008/C 111/01)

**EDUCATION**
- **EQF Level 6** (e.g., Bachelor with 180 - 240 ECTS)
  1. (i) Physics or equivalent
- **EQF Level 7** (e.g., Master with 90 - 120 ECTS)
  1. (iii) Medical Physics or equivalent
  2. (iv) Medical Physics

**CLINICAL TRAINING**
- **Clinical Certification in Medical Physics Specialty**
  1. (vi) Structured accredited clinical training residency in the specialty of Medical Physics in which the candidate seeks clinical certification. The duration should be typically two full-time year equivalents

**ADVANCED EXPERIENCE and CPD**
- **EQF Level 8 in Medical Physics Specialty**
  1. (vii) Structured accredited advanced experience and CPD in the specialty of Medical Physics in which the candidate seeks certification as MPE. The duration would be an additional minimum of two full-time year equivalents
  2. (viii) 

**RECOGNITION**
- By Competent Authorities as MPE in Medical Physics specialty
  1. (ix)

**RE-CERTIFICATION**
- 5 year CPD cycle
  1. (x)

* Should include, as a minimum, the educational components of the Core KSC of Medical Physics and the educational components of the KSC of the specialty of Medical Physics (i.e., Diagnostic & Interventional Radiology or Nuclear Medicine or Radiation Oncology) for which the candidate seeks clinical certification. When this element of specialization is not included it must be included in the residency.

** The EQF level of the residency is intermediate between EQF levels 7 and 8.

*** In countries where the MPE is required to be certified in more than one specialty of Medical Physics the number of years would need to be extended such that the MPE will achieve level 8 in each Specialty.
How we got started (2)
<table>
<thead>
<tr>
<th>Knowledge (facts, principles, theories, practices)</th>
<th>Skills (cognitive and practical)</th>
<th>Competence (responsibility and autonomy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K1. Explain statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Scientific Problem Solving Service.</td>
<td>S1. For each modality, operate imaging devices at the level necessary for giving advice on optimization of imaging protocols, quality control, image quality manipulation, and carry out research when the available evidence for advice is not sufficient.</td>
<td>C1. Take responsibility for statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Scientific Problem Solving Service.</td>
</tr>
<tr>
<td>K2. Explain the common imaging modalities (general projection x-ray imaging (CDR, CR and film-screen where this is still valid), chest systems, mammography, dental systems (intra-oral, OPT, cephalometric systems), mobile, flat panel / image intensifier fluoroscopes including C-arms, interventional systems, tomosynthesis, paediatric systems, radiostereometric (RSA) systems, stereolaetic systems, dual energy X-ray absorptiometry (DXA), axial and helical mode CT, cone-beam CT, MRI, ultrasound) and explain their function as instruments for the measurement, mapping and imaging of the spatial distribution of different physical variables within the human body. Each imaging modality/dedicated device has its utility in the various applications of medical imaging i.e., diagnosis, population screening, patient monitoring, intervention and specialized use such as paediatric.</td>
<td>S2. For each modality predict the effect on image quality and diagnostic accuracy when changing scanning and reconstruction parameters.</td>
<td>C2. Carry out or supervise as appropriate the measurement of physical quantities relevant to the effective, safe and economical use of medical devices/ ionizing radiations and other physical agents in Diagnostic and Interventional Radiology.</td>
</tr>
<tr>
<td>K3. Discuss the advantages and disadvantages of imaging as a means of displaying spatially dependent signals and variables.</td>
<td>S3. Manipulate acquisition parameters for all forms of projection x-ray imaging devices (e.g., kV, filtration, mAs, sensitivity (‘speed’), collimation, magnification, SID, SSD, frame rate, screening time, manual/AED modes, compression), explain the effect on image quality and relevant patient dose quantities (and occupational dose particularly when this is correlated with patient dose) and relevance to specific clinical studies.</td>
<td></td>
</tr>
<tr>
<td>K4. Explain in detail the principles of image quality measurement: linear systems theory, types of contrast (subject, image and display), unsharpness (LSR, PSF, LSF, MTF), lag, noise (including sources, noise power spectra, effect of lag on noise, noise propagation in image subtraction). SNR (using Rose model, Wagner’s taxonomy, CNR, relation to dose, NEQ, DQE, NPS etc).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K5. Explain inverse problem mathematical techniques used in image reconstruction (including both convolution and iterative methods and the advantages and disadvantages of each).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K6. Explain at an advanced level the following: temporal / frequency domain representation of signals, Fourier transform, statistical description of signals, power spectral density, autocorrelation function, sampled (discrete) signals, delta function and its Fourier transform, Fourier transform of aperiodic discrete signal (DFT), the FFT, the effects of finite sample intervals, linear processors, impulse response, convolution integral and theorem, various types of filters used in the processing of medical signals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K7. Explain in detail the way that acquisition data is processed to facilitate the extraction of information.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K8. Explain the principles and role of image post-processing including knowledge based image analysis, pattern theory, deterministic image processing and feature enhancement, image segmentation, image registration and co-registration.</td>
<td></td>
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</tr>
<tr>
<td>K9. Discuss the limitations of image post-processing.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Suddenly, the EU EURATOM asked for projects on Teaching and Education to increase nuclear safety ....
Our project application was convincing:

• We can increase nuclear safety in RX with MPEs
• None of the EU Member States has the required training programs at EQF level 8
• We can realize borderless, life long learning, with e-learning and other modern teaching methods
• Radiology is important (business)
• Yes, there is excellence in Europe

-> Cherry-picking!
History

• Successful application for a Euratom ‘Fission Training Scheme’

• EU support: 1.7M€

• Timing:
  01/08/2013 - 31/07/2016
Objectives

- Provide a modular training scheme for the MP in Radiology at EQF level 8
- Set up a multicampus education combining online with face-to-face learning
- Serve as a model for harmonised courses
- Get accredited (by EFOMP)
- To achieve excellence in:
  - module content (RP174) and organization
  - fulfillment of quality objectives
  - participant and stakeholder satisfaction
## Course modules

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Development of the profession and the challenges for the MPE (D&amp;IR) in Europe</td>
<td>C. Caruana &amp; E. Vano</td>
</tr>
<tr>
<td>2</td>
<td>Radiation biology for medical physicists in radiology</td>
<td>A. Ottolenghi &amp; K Trott</td>
</tr>
<tr>
<td>3</td>
<td>Monte Carlo simulation of X-ray imaging and dosimetry</td>
<td>J. Sempau</td>
</tr>
<tr>
<td>4</td>
<td>Advanced X-ray physics for imaging devices and user protocol innovation in D &amp;IR</td>
<td>M. Gambaccini, A T.aibi</td>
</tr>
<tr>
<td>5</td>
<td>Antropomorphic phantoms</td>
<td>K. Bliznakova</td>
</tr>
<tr>
<td>6</td>
<td>The development of advanced QA protocols</td>
<td>H. Bosmans, N Marshall &amp; E. Vano</td>
</tr>
</tbody>
</table>
## Course modules

<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Advanced measurements of the performance of X-ray imaging systems &amp; optimization</td>
<td>K. Young &amp; A. MacKenzie</td>
</tr>
<tr>
<td>8</td>
<td>Model Observers: theory and application for CT optimization</td>
<td>F. Verdun &amp; F Bochud</td>
</tr>
<tr>
<td>9</td>
<td>Achieving quality in diagnostic and screening mammography</td>
<td>R. van Engen, W. Veldkamp &amp; I. Sechopoulos</td>
</tr>
<tr>
<td>10</td>
<td>High dose X-ray procedures in Interventional Radiology and Cardiology</td>
<td>A. Trianni, R. Padovani &amp; E. Vano</td>
</tr>
<tr>
<td>11</td>
<td>Radiation dose management of pregnant patients, pregnant staff and children in diagnostic and interventional radiology</td>
<td>J. Damilakis</td>
</tr>
<tr>
<td>12</td>
<td>Personnel dosimetry: Techniques and Applications</td>
<td>M. Borowski &amp; M. Fiebich</td>
</tr>
</tbody>
</table>
EUTEMPE-RX method
EUTEMPE-RX method

• Common platform, common structure, ...
• 6 monthly consortium meetings with educational workshops:
  • the use of e-learning tools
  • the creation of e-learning material
  • assessment methods at the expert level
  • teaching methods
• Room for sharing teaching experiences, hints & tricks
Example of e-learning material

4 Documents for further reading
- Introduction
- European documents
- International documents
- Conclusion

8 Phantoms for QA
- Introduction
- Types of phantoms
- Mammography - CDMAM
- General Radiography/Fluoroscopy - CDRAD
- Fluoroscopy - TOR18FG
- Fluoroscopy - TO20
- Computerized tomography (CT)
- Computerized tomography (CT)
- Computerized tomography (CT)
- Conclusions

14 Literature search: Elements for consolidating and improving QA in X-ray imaging
- Introduction: Literature survey on QA in diagnostic radiology
- QA means being organized and ambitious
- New phantoms (often task-based) and new QC procedures
- New methods to automate QC data analysis
- Conclusion
Science on the e-learning platform

MPE03: Monte Carlo simulation of x-ray imaging

This course aims at providing the theoretical and practical abilities needed to apply Monte Carlo simulation of radiation transport to x-ray imaging problems and to effectively use a general-purpose Monte Carlo code in simple situations. The coupling between ionizing radiation and visible light, or electron-hole pairs. In conventional x-ray digital detectors will also be addressed.

Undersampling and aliasing

In a sampled system such as a digital detector there is a limit on the spatial frequencies that can be accurately sampled. The Nyquist frequency \( \nu_N \) defines the limiting spatial frequency and is related to the panel pitch \( (d) \) as follows in the \( \lambda \) and \( \mu \) directions of the detector:

\[ \nu_N = \frac{1}{2d} \]

Input signals at spatial frequencies higher than the Nyquist frequency will be aliased and appear in the output signal with a lower spatial frequency. The application of the sampling comb (SC) to the input signal \( \mathbf{f}(x,y) \) can be described as:

\[ \mathbf{f}_{sc}(x,y) = \mathbf{f}(x,y) \cdot \mathbf{h}(x,y,\alpha,\beta) \]

In terms of spatial frequencies this can be written:

\[ \mathbf{f}_{sc}(u,v) = \mathbf{F}^{-1} \left\{ \mathbf{F}(u,v) \cdot \mathbf{H}(u,v,\alpha,\beta) \right\} \]

where \( \mathbf{F}(u,v) \) is the Fourier transform of \( \mathbf{f}(x,y) \), \( u \) and \( v \) are the spatial frequencies corresponding to the \( \lambda \) and \( \mu \) directions, \( \mathbf{H}(u,v,\alpha,\beta) \) is the inverse Fourier transform. \( \mathbf{F}^{-1} \) is the resultant image.

Aliasing adversely affects the image quality, as the spatial frequencies above the Nyquist frequency in the input image are not accurately represented in the output image. It is not possible to remove aliasing from an image, although it is possible to reduce aliasing by altering the design of the imaging system. A smaller panel pitch will increase the Nyquist frequency as well blurring if introduced into the imaging system before sampling occurs. Both of these changes have the effect of reducing the signal above the Nyquist frequency and thus aliasing.
Example of e-learning teaching

2.1. Introduction

In the 3D imaging part of the course stereoscopic imaging, breast tomosynthesis and breast CT will be discussed. The emphasis of this part of the course will be on tomosynthesis: the technologies employed by different manufacturers will be discussed, some basics will be explained about image reconstruction and some information on recent developments like synthetic 3D views and slabbing of focal planes will be given.

Further reading


If you have questions or would like a Skype meeting for clarification, mail to: EUTEMPE@ebc.nl

In the image quality and dosimetry part of the course the different methods to quantify image quality will be introduced. Besides this a new approach to quantify clinical image quality using model observers is explained. This method is still in development but is also being evaluated in other field of imaging, e.g. CT imaging, so it is important that a medical physics expert has sufficient knowledge in this field.

Another part of this section of the course deals with breast dosimetry with focus on the dosimetry model of David Dance which is commonly used in Europe.

Further reading Dosimetry

Upfront introduction of the teachers

<table>
<thead>
<tr>
<th>ANNALISA TRIANNI</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="mailto:trianni.annalisa@eoud.sanita.fvg.it">trianni.annalisa@eoud.sanita.fvg.it</a></td>
</tr>
</tbody>
</table>

- Medical Physicist – Medical Physics Department University Hospital 1, Maria delle Misericordie of Udine
- Present activities:
  - Chair of EPOS-IDCOM: Work on White Report to review Patient Dosimetry in Diagnostic Imaging
  - Member of AAPM/IMP DICOM Coordination
  - Member of EURADOS WG 2: Chair of SG 2 on “Patient Radiation Dosimetry in Diagnostic and Interventional Procedures”. Working on the development and implementation of Trigger Levels for Interventional procedures and on Skin dosimetry
  - Coordinator of AIPM working group on Digital Radiology. Working on a national protocol for Quality Assurance of Equipment and Performance Assessment of Equipment to be used in Interventional Procedures
  - ISS-AGENAS project. Work on optimisation in Interventional radiology and cardiology
Think...

- Could you try to guess possible pros and cons of the two types of computational phantom descriptions and design approaches?

<table>
<thead>
<tr>
<th>Solid Geometry (Pros)</th>
<th>Voxel based (Pros)</th>
</tr>
</thead>
<tbody>
<tr>
<td>best suited for surface deformation</td>
<td></td>
</tr>
<tr>
<td>no discretisation error</td>
<td></td>
</tr>
<tr>
<td>realistic shapes</td>
<td></td>
</tr>
<tr>
<td>low resolution</td>
<td></td>
</tr>
<tr>
<td>memory demanding</td>
<td></td>
</tr>
<tr>
<td>patient specific</td>
<td></td>
</tr>
</tbody>
</table>
Example of face-to-face course
Module on Advanced QA

• Industrial partner & President of article 31 group: what is QA?
• Have 2 group leaders share how QA is being organized
• Practical sessions showing how QA is done in Leuven
• Go from basic QA to advanced (task based) QA: how and why
• Group work: how to compile a new QA protocol – do it - report
• Digital opportunities and measurements of digital systems explained
• Hints and tricks!
• Testing the overlooked components
• Assessment = make the outline for a task based QA protocol
Teaching methods in practice

• **Unique achievements**
  – case studies in medical physics leadership
  – Monte Carlo simulation of a complete x-ray imaging chain
  – task specific QA protocols
  – new optimization plans
  – simulation with anthropomorphic breast models
  – individualized dose calculation
Teaching methods in practice

• **Unique opportunities & encounters**
  – with the team of teachers
  – with medical doctors
  – modern hospitals
  – top screening organization
  – a synchrotron facility
  – a calibration lab, ...
Teachers’ reflections

- Extremely, positively motivated groups of participants
- Every new group = a new team of (young) medical physicists
- Group tasks were most appreciated
- Social events are a necessary part. Most courses take place in nice historical cities
Quality of the project

• **Criteria described in the Quality manual**
  – Knowledge skills and competences listed
  – Courses accredited by EFOMP
  – Quality survey sent to participants
  – Follow up web conference with module leaders & educational team
Quality

- Approx. 50 – 50 m/f
- Applicants from all over Europe and beyond
For more info: see quality manual

[Image of a document with text]

Module MPE01: Development of the profession and the challenges for the MPE (D&IR) in Europe

**Title:** Development of the profession and the challenges for the MPE (D&IR) in Europe

**Module Code:** MPE01

**Module Level:** ECF level 8

**Aims:** This module aims to help the future MPEs acquire the knowledge, skills and competences necessary to address the development of the role of the MPE. Phase participants will have the opportunity to review the latest EU directives, guidelines and activities.

**Learning Outcomes:** At the end of the module, the participant should be able to:

- Take responsibility for research, development and clinical governance of the MPE.
- Implement and evaluate strategic solutions for the MPE.
- Take responsibility for the role of the MPE in research, development and clinical governance.
- Discuss the role of the MPE (D&IR) in health technology.
- Manage inter-professional issues in D&IR.
- Discuss the role of the MPE (D&IR) in health technology.
- Evaluate the various models of management suitable to the role of MPEs.
- Manage priorities regarding radiation protection research and MPEs.
- Interpret the significance of the MPE (D&IR) in health technology.
- Implement safety culture in their management practice.

**Faculty:** Carmel J. Caruana, Eliseo Vano

**Module Leaders:**

- Prof. Carmel J. Caruana (carmela@medrapet.org), Past EFOMP Chair for E&T and Full Professor of Medical Physics at the Health for radiological protection.
- Prof. Eliseo Vano (eliseovano@medrapet.org), Chairman of the Committee on MPEs.

**Module Content:**

**AIM and SUMMARY**

<table>
<thead>
<tr>
<th>Aim</th>
</tr>
</thead>
<tbody>
<tr>
<td>This module will help the future MPE (Diagnostic and Interventional Radiology department) acquire the knowledge, skills and competences necessary to address the development of the role of the MPE. The content of the module will address the development of the role of the MPE in other modules. In the face-to-face phase participants will have the opportunity to review the latest EU directives, guidelines and activities.</td>
</tr>
</tbody>
</table>

**Learning Outcomes**

(10 - 15 learning outcomes which provide an overview of the KSC addressed in the module)

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPE01.01 Take responsibility for researching, evaluating, leading the MPE in the ambit of European and national legislation and regulations.</td>
</tr>
<tr>
<td>MPE01.02 Evaluate the various models of management suitable to the role of MPEs.</td>
</tr>
<tr>
<td>MPE01.03 Take responsibility for researching, evaluating, leading the MPE in the ambit of European and national legislation and regulations.</td>
</tr>
<tr>
<td>MPE01.04 Implement and evaluate strategic solutions to the challenges faced by the MPE.</td>
</tr>
<tr>
<td>MPE01.05 Discuss the role of the MPE (D&amp;IR) in health technology.</td>
</tr>
<tr>
<td>MPE01.06 Take responsibility for ethical issues in the area of radiation protection.</td>
</tr>
<tr>
<td>MPE01.07 Discuss the role of the MPE (D&amp;IR) in health technology.</td>
</tr>
<tr>
<td>MPE01.08 Manage inter-professional issues in D&amp;IR.</td>
</tr>
<tr>
<td>MPE01.09 Manage priorities regarding radiation protection research and MPEs.</td>
</tr>
<tr>
<td>MPE01.10 Implement safety culture in their management practice.</td>
</tr>
<tr>
<td>MPE01.11 Participate in networks for research and development.</td>
</tr>
</tbody>
</table>

**Total participant effort time:** 8 hours

**Assessment Mode:** The assessment is expected to demonstrate the development of the profession. Participants are expected to demonstrate the development of the profession during the course.
## Quality survey results

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>The learning goals of this module (found on the description page of the module) were clear to me.</td>
<td>0.6</td>
<td>1.9</td>
<td>6.5</td>
<td>35.1</td>
<td>55.9</td>
</tr>
<tr>
<td>This level of the module helped me achieve EQF level 8 in the areas covered by the module.</td>
<td>0.6</td>
<td>1.7</td>
<td>13.9</td>
<td>42.5</td>
<td>41.3</td>
</tr>
<tr>
<td>Participation in this module enabled me to develop learning goals relevant to my professional objectives.</td>
<td>1.0</td>
<td>2.2</td>
<td>8.5</td>
<td>30.8</td>
<td>57.5</td>
</tr>
<tr>
<td>The module leader(s) and presenters had a good command of the subject matter of the course.</td>
<td>0.0</td>
<td>0.0</td>
<td>4.2</td>
<td>21</td>
<td>74.8</td>
</tr>
<tr>
<td>The study materials (online work, articles, hand-outs, face-to-face presentations, ...) were sufficient for me to master the learning goals.</td>
<td>0.5</td>
<td>2.4</td>
<td>12.8</td>
<td>34.2</td>
<td>50.1</td>
</tr>
<tr>
<td>The assessment (e.g. paper, examination, exercises, ...) allowed me to show my level of achieved knowledge/skills/competences.</td>
<td>1.4</td>
<td>5.4</td>
<td>18.0</td>
<td>40.2</td>
<td>35.0</td>
</tr>
<tr>
<td>The knowledge, skills and competences supported by this module match with those expected by my employer.</td>
<td>1.7</td>
<td>3.0</td>
<td>17.0</td>
<td>39.6</td>
<td>38.7</td>
</tr>
</tbody>
</table>
Sustainability

- Creation of the EUTEMPE-net
- Modules will be repeated (at a fee from 500 – 900 €)
- The consortium will go on with yearly meetings
  - for harmonization
  - for feedback and follow-up
  - to plan and explore new teaching methods
- A new group of excellence will apply for the next EURATOM call, Oct 2016
Sustainability with the EUTEMPE-net

Diagram illustrating the structure of the EUTEMPE-net, including:
- General Assembly
- Executive Board
- Educational Board
- Secretariat
- Quality Assurance Committee
- Diagnostic & Interventional Radiology School Board
- Radiotherapy School Board
- Nuclear Medicine School Board
- Other MPE School Boards
- External Accreditation
- External Certification
## Sustainability plan

**Deadline for application of 1 Nov 1st, 2016**

<table>
<thead>
<tr>
<th>Module Code</th>
<th>Module Topic</th>
<th>Leaders</th>
<th>Face-to-face Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPE01</td>
<td>Leadership in Medical Physics: Development of the profession and the challenges for the MPE (D&amp;R)</td>
<td>C. Caruana &amp; V. Tsapaki</td>
<td>6-10 February 2017, Prague, Czech Republic</td>
</tr>
<tr>
<td>MPE02</td>
<td>Radiation biology for medical physicists in radiology</td>
<td>A. Ottolenghi, G. Biocchi</td>
<td>15-19 January 2018, Pavia, Italy</td>
</tr>
<tr>
<td>MPE03</td>
<td>Monte Carlo simulations of X-ray imaging and dosimetry</td>
<td>J. Sempau</td>
<td>19-23 June 2017 (Provisional), Barcelona, Spain</td>
</tr>
<tr>
<td>MPE04</td>
<td>Innovation &amp; Advanced X-ray physics for imaging devices in Diagnostic and Interventional Radiology</td>
<td>A. Taibi &amp; M. Gambaccini</td>
<td>11-15 September 2017, Ferrara, Italy</td>
</tr>
<tr>
<td>MPE05</td>
<td>Physical and virtual anthropomorphic phantoms for image quality and patient dose optimization</td>
<td>K. Bliznakova</td>
<td>22-26 May 2017, Varna, Bulgaria</td>
</tr>
<tr>
<td>MPE07</td>
<td>Optimisation of X-ray imaging using standard and innovative techniques</td>
<td>A. Mackenzie &amp; K. Young</td>
<td>9-11 Oct. 2017 with extensive e-learning part and possibility to register for the e-learning only, Guildford, UK</td>
</tr>
<tr>
<td>MPE08</td>
<td>Mathematical model observers developed and implemented for patient dose optimization in CT</td>
<td>F. Verdun &amp; F. Bochud</td>
<td>12-16 March 2018, Lausanne, Switzerland</td>
</tr>
<tr>
<td>MPE09</td>
<td>Achieving quality in diagnostic and screening mammography</td>
<td>R. Van Engen, J. Sechopoulos &amp; W. Veldkamp</td>
<td>27-31 March 2017, Nijmegen, the Netherlands</td>
</tr>
<tr>
<td>MPE10</td>
<td>High-dose X-ray procedures in Interventional Radiology and Cardiology; Establishment of robust protocols for patient and staff dose</td>
<td>A. Trianni, R. Padovani &amp; E. Vano</td>
<td>25-29 June 2018 (to be confirmed), Udine, Italy</td>
</tr>
<tr>
<td>MPE11</td>
<td>Radiation dose management of pregnant patients, pregnant staff and paediatric patients in diagnostic and interventional radiology</td>
<td>J. Damilakis</td>
<td>21-25 May 2018, Iraklion (Crete), Greece</td>
</tr>
<tr>
<td>MPE12</td>
<td>Personnel dosimetry and techniques to communicate practical results to the users (tasks of the radiation protection expert, RPE)</td>
<td>M. Borowski &amp; M. Fleisch</td>
<td>15-20 April 2018, Braunschweig, Germany</td>
</tr>
</tbody>
</table>
The challenge is this:

• We need more leaders in our profession.
• We aim to train them to the best level possible.
• We know how to train them.
• How to reach all?
We welcome also US participants cooperation with AAPM exchange of ideas...

For more information, visit our website: www.eutempe-RX.eu
You can register now: First come, first served.