

EUTEMPE-RX QUALITY ASSURANCE COMMITTEE

Module Approval Form (Content and Organization)

Quality Manual: “All modules forming part of the EUTEMPE-RX module catalogue are required to be formally approved by the **EUTEMPE-RX Education Board** in terms of content and organization prior to delivery. Such approval will be communicated to the module leader/s in writing by the Secretary of the Education Board. The leader/s of the particular module will apply for such approval on the official **Module Approval Form (Content and Organization)** provided by the **Quality Assurance Committee (QAC)**. The request for approval should be sent to the Secretary of the Education Board. In its deliberations the Educational Board will take into consideration the recommendations of the QAC. Records of the results of the review of the QAC and any associated actions will be registered by the secretary of the QAC”

PRINCIPLES GUIDING MODULE CONTENT

The following quotes from the key documents of the EUTEMPE-RX project should guide module content and organization:

European Qualifications Framework definition of Level 8

Knowledge: “knowledge at the most advanced frontier of a *field of work* or study and at the interface between fields”

Skills: “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*”

Competence: “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 including research”

European Guidelines on the MPE

“The question arises which of these KSC are expected to be achieved by the medical physics professional at the end of the two years equivalent clinical training following the Masters in Medical Physics (EQF level 7+) and which at the MPE level (EQF level 8). In general most of the knowledge, a substantial number of the skills and some of the competences should be acquired by the end of the initial two year clinical training. The skills and competences to be acquired by the end of the two years equivalent clinical training following the Masters in Medical Physics (EQF level 7+) are those defined by the IAEA training documents (Clinical Training of Medical Physicists Specializing in Diagnostic Radiology. Training Course Series, 47, IAEA, 2010, http://www-pub.iaea.org/MTCD/publications/PDF/TCS-47_web.pdf). However, as Medical Physics is by nature complex it must be emphasized that these skills and competences are developed over a period of years. *The majority of the skills and competences would be acquired to the appropriate effective and safe level only at the MPE level i.e., level 8*”

EUTEMPE-RX Quality Manual

“*EUTEMPE-RX will focus on the development of skills and competences to EQF level 8. Knowledge learning outcomes will also be included when the knowledge level presently acquired in Level 7 programmes is considered insufficient for the development of skills and competences to level 8*”

EUTEMPE-RX Project Description-of-Work:

“Each module should typically include:

- a clearly defined topic
- list of KSC to be achieved in line with the key activities of the MPE as formulated in the ‘European Guidelines for the MPE’ project and in accordance with interests formulated by MELODI, DOREMI and HLE
- both theoretical and practical training sessions
- a state-of-the-art literature review and collection of educational material on the topic
- an example on how to transfer research results to clinical practice
- an example of innovation
- the use of associated software tools
- a practical challenge to be solved
- a module evaluation method and evaluation moment

ABSTRACT

The first two pages of the Module Approval Form are dedicated to an ABSTRACT which describes the module content and organization in brief. Please keep to the desired format. This abstract will be presented on the EUTEMPE-RX webpage and used for PR activities. Often potential participants only have time to read the abstract. The abstract must therefore be striking and informative enough to stimulate interest in potential participants.

Notes:

- a) The abstract should be 2 pages maximum
- b) The module code is *MPEmodulenummer* (e.g., *MPE01 to MPE12*)
- c) Use font calibri size 10
- d) Each module is very comprehensive and will address a large number of KSCs from the 'Inventory of Learning Outcomes for the MPE in Europe' (rp174_annex1 of the 'European Guidelines on the MPE). These KSCs will be found in the full module description. The **Summary Learning Outcomes** in the abstract represent a brief summary of these KSCs.
- e) The numbering of the Summary Learning Outcomes should be in the form *MPEmodulenummer.summarylearningoutcomenummer* (e.g., *MPEXX.01, MPEXX.02...*)
- f) **Please remember that these are all level 8 modules.** Therefore use **ONLY level 8 action verbs** for the Summary Learning Outcomes e.g., take responsibility for, implement, manage, evaluate, research, lead, design, develop, discuss...

Module MPE12: Personnel dosimetry - Preliminaries, Techniques and Applications

ABSTRACT

Title: Personnel dosimetry of the personnel - Preliminaries, Techniques and Applications

Module Code: MPE12

Module Level: EQF level 8

Aims: All persons exposed to ionizing radiation during work without being patients, have to be monitored by personnel dosimetry. The objective of the monitoring is to guarantee that thresholds are not exceeded, e.g. 20 mSv per year for the whole body dose $H_p(10)$ for occupationally exposed personal. Further regulations are effective for the monitoring of organ doses for the skin, the eye lens and extremities.

For some clinical disciplines, especially those being involved in interventional procedures, the permitted annual dose levels might limit their clinical involvement. Further a detailed knowledge of the organ doses as well as effective doses resulting from different procedures is extremely useful in optimizing clinical processes as well as the related patient care. For an efficient use of occupational dosimetry in optimization and management processes it is essential to have a profound understanding of the existing dosimetry systems in use, especially their uncertainties and their pro and cons. The physical and technical processes of dosimetry systems in use differ significantly. Measurement uncertainties, sensitivity to disruptive factors and their field of application vary considerably.

The occupational dosimetry is not unquestioned among users. There are several million persons monitored by occupational dosimetry in Europe each year. From these, less than 5% are exposed to levels of more than 1 mSv per year. Occupational doses for the extremities as well as eye lenses are even less often at a critical height. Thus, a lot of effort and money is continuously being spent without any benefit. This lack of benefit to the individual often results in reluctance in compliance to personal dosimetry. Moreover, information of measured doses of the occupational personal are not communicated well, resulting consequences or achieved improvements are not discussed actively in the team.

Within this course the participants will receive a comprehensive knowledge on personnel dosimetry. This includes knowledge on the underlying epidemiological basics, the dosimetry and developed dosimetry systems, the exposure situations and resulting needs on site. Finally, the participants will be enabled to discuss this topic to hospital managements, the scientific community and political interest groups.

Learning Outcomes: At the end of the module the participants will be able to:

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| MPE12.01 | Take responsibility for the specification and selection of dosimetry systems for personnel dosimetry. |
| MPE12.02 | Take responsibility for the clinical dosimetry of the personnel, including education of the personnel in diagnostic and interventional radiology |
| MPE12.03 | Assess, evaluate and optimise dose of the personnel in clinical situations in diagnostic and interventional radiology. |
| MPE12.04 | Apply knowledge into further research and development in dosimeters and optimization techniques for further dose reductions of the personnel. |
| MPE12.05 | Discuss the role of the MPE (D&IR) in health technology assessment (HTA), innovation and expert consultancy. |
| MPE12.06 | Manage inter-professional issues in D&IR. |
| MPE12.07 | Implement safety culture in their management practice. |
| MPE12.08 | Interpret the significance of liaising with the Radiation Protection Expert |

Date and Location of Face-to-Face Component: 17 – 22 April 2016; Braunschweig, Germany

Module Leaders:

Dr. Markus Borowski, Institute of Diagnostic Radiology and Nuclear Medicine, Klinikum Braunschweig, SalzdahlumerStr. 90, 38126 Braunschweig, Germany. phone: +49-531-5952137, email: m.borowski@klinikum-braunschweig.de

Dr. Markus Borowski is leading medical physicist of the radiation diagnostics and nuclear medicine department. Since a number of years he is engaged in the committee 'radiation techniques' of the radiation protection commission (SSK) of the German federal ministry of the environment and its working groups. He is member of the competent medical authority of the federal states of Lower Saxonia / Bremen, Hamburg and "Schleswig-Holstein" and within the board of the German Association of Physicists in Medicine (DGMP). He is strongly involved in teaching courses in radiation protection, e.g. at the medical association of Lower-Saxonia, since a number of years. He was project leader in some funded projects of the Germans federal ministry of the environment, e.g. dealing with topics of personnel dosimetry and quality assurance in radiation diagnostics.

Prof. Dr. Martin Fiebich, Institute of Medical Physics and Radiation Protection, University of Applied Sciences, Wiesenstr. 14, 35390 Giessen, Germany. Phone: +49-641-3092573, email: Martin.Fiebich@kmub.thm.de

Prof. Martin Fiebich is full professor of Medical Physics in the Institute of Medical Physics and Radiation Protection at the University of Applied Sciences in Giessen, teaching basic and advanced Medical Physics and Radiation Protection to Medical Physics students. He is also acting as Convenor of the working group „Medical Imaging“ of the German Institute for Standardization (DIN) in Germany and member of the working groups „Radiation protection techniques“ and „Quality Assurance in Medicine“ in the German radiation protection commission (SSK). He is member of the competent medical authority of the federal states of Hesse in Germany. He is elected Section leader „Medical Imaging“ and board member of the German Society of Medical Physics (DGMP). Prof. Martin Fiebich, his colleagues and his staff are invited speakers in many conferences and congresses, especially on digital imaging, quality assurance aspects in medical imaging and interventional radiology.

Faculty: Markus Borowski, Martin Fiebich and further members of their institutes and external experts

Delivery of the module: The course is being delivered as blended course, starting with an online course phase of 5 days followed by an onsite phase of 5 days. The onsite phase will be held in Braunschweig / Germany. In the online phase of the course in a common course scheme knowledge will be presented. The intention of this part is to reach a level of theoretical knowledge among the participants, which enables a good learning outcome at the onsite phase. Within the onsite phase the theoretical topics will be repeated and extended by lectures being held by experts in the individual field. The main part of the onsite phase, however, is related to gain practical knowledge in the use of the different dosimetry systems, understand their limitations and to investigate the doses and exposure conditions at different work places within hospitals.

Total participant effort time: 80 to 90 hours (depends on prior knowledge, working speed and the choose of the assessment method)

Assessment Mode: There will be two assessments during the face-to-face phase.

1st: There will be two larger sections of lab work within the face-to-face phase – a) evaluation of response criteria of different active electronic personal dosimeters, b) evaluation of radiation exposure in interventional suites. The participants will have to choose one of both from which their skills and competences in a) formulating relevant research questions, b) setting up and collecting the measurements, c) dealing with unexpected findings and problems, d) analyzing the data and assessing measurement uncertainties, e) presenting and discussing the results will be assessed.

2nd: In the end of the face-to-face phase the participants have to choose one of two possible tests: a) an closed book written examination (90 minutes), where the participants have to answer six questions covering the main KSCs of the module. b) conduction of a project at their home sites including a written report (approx.. 15-20 pages) containing 1. Motivation, 2. Materials & methods, 3. Results, 4. Evaluation. Preferentially option b) shall be chosen. It might, however, be the case that for individual reasons there is no chance to set up and perform a suitable project at a participant's home site. For these group an alternative assessment method is offered in the form of the closed book examn.

We expect that the chosen methods are able to proove that the participants are able to communicate effectively clinical information, advice, instruction and share professional opinion to patients, colleagues, other healthcare professionals, support staff, service users, relatives, carers, comforters and volunteers in medical research within own area of medical physics practice using appropriate terminology. The participants confirm that they can make best use of available resources in the interest of patients and society with respect to personnel dosimetry and that they can organise the various aspects of the routine service within their own area of medical physics practice.

Module Homepage: Set by Leuven. Please contact Roman Verraest.

MODULE DATA

Module Homepage	Set by Leuven. Please contact Roman Verraest.
Module Code	MPE12
Module Leader/s	<p>Dr. Markus Borowski Institute of Diagnostic Radiology and Nuclear Medicine, Klinikum Braunschweig, Germany. phone: +49-531-5952137, email: m.borowski@klinikum-braunschweig.de Leading medical physicist of the radiation diagnostics and nuclear medicine department. Strong involvement in competent medical authorities of three German states; engagement in working groups of the radiation protection commission (SSK) of the German federal ministry of the environment; member of the board of the German Association of Physicists in Medicine (DGMP). Diverse studies in the area of personnel dosimetry, especially in the chances and limitations in the use of direct reading personal dosimeters.</p> <p>Prof. Dr. Martin Fiebich, Institute of Medical Physics and Radiation Protection, University of Applied Sciences, Giessen, Germany. Phone: +49-641-3092573, email: Martin.Fiebich@kmub.thm.de Convenor of the working group „Medical Imaging“ of the German Institute for Standardization (DIN) in Germany; member of the working groups „Radiation protection techniques“ and „Quality Assurance in Medicine“ in the German radiation protection commission (SSK). Member of the competent medical authority of the federal state of Hesse in Germany. Elected Section leader „Medical Imaging“ and board member of the German Society of Medical Physics (DGMP). Profound knowledge in the preparation and delivery of E-learning contents.</p>
Teaching Staff	<p>Markus Borowski PhD: Module leader Prof Martin Fiebich PhD: Module leader Prof Rolf Michel PhD Prof Peter Ambrosi, PhD Prof Christoph Höschen, PhD Matthias Lüpke, PhD Jörg Engelhardt, PhD Oliver Hupe, PhD Jörg Jurtschak (representing RaySafe real time dosimetry system) n.n. (representing Philips software to join real time dosimetry and patient dosimetry)</p> <p>and Sarah Wrede (MPE) as well as Lukas Bogunovic (PhD) for the practicals</p>

Candidate Assessment	<p>There will be two assessments during the face-to-face phase.</p> <p>1st: There will be two larger sections of lab work within the face-to-face phase – a) evaluation of response criteria of different active electronic personal dosimeters, b) evaluation of radiation exposure in interventional suites. The participants will have to choose one of both from which their skills and competences in a) formulating relevant research questions, b) setting up and collecting the measurements, c) dealing with unexpected findings and problems, d) analyzing the data and assessing measurement uncertainties, e) presenting and discussing the results will be assessed.</p> <p>2nd: In the end of the face-to-face phase the participants have to choose one of two possible tests: a) an closed book written examination (90 minutes), where the participants have to answer six questions covering the main KSCs of the module. b) conduction of a project at their home sites including a written report (approx.. 15-20 pages) containing 1. Motivation, 2. Materials & methods, 3. Results, 4. Evaluation. Preferentially option b) shall be chosen. It might, however, be the case that for individual reasons there is no chance to set up and perform a suitable project at a participant’s home site. For these group an alternative assessment method is offered in the form of the closed book examn.</p> <p>We expect that the chosen methods are able to prove that the participants are able to communicate effectively clinical information, advice, instruction and share professional opinion to patients, colleagues, other healthcare professionals, support staff, service users, relatives, carers, comforters and volunteers in medical research within own area of medical physics practice using appropriate terminology. The participants confirm that they can make best use of available resources in the interest of patients and society with respect to personnel dosimetry and that they can organise the various aspects of the routine service within their own area of medical physics practice.</p>	
Module Duration The TOTAL number of hours of participant effort should be about 80. (including lectures, reading of assigned compulsory texts, participation in online fora etc)	Online phase Asynchronous methods should be used whenever possible so that participants would not need to take time off their clinical duties and there will not be a problem with time zones. However synchronous methods (evenings or weekends only) should be used when crucial.	The online component will be available approx.. 8 weeks before start of the on-site phase and requires approximately 35 hours of working effort inclusive homeworks. The online phase will be asynchronous so that participants would not need to take time off their clinical duties and there will not be a problem with time zones.
	Face-to-face phase .	5 days: starting with half a day of welcoming and content delivery at first day and half a day of content delivery on last day; in total approx.. 45 hours of content, revision of the content will be performed consecutively along the face-to-face period, thus no special revision day is scheduled; assessment, if chosen as written examn, will be performed on final half day of the course
Date and location of Face-to-Face	18 – 22 April 2016; Braunschweig, Germany	

Date of Assessment Normally last day of face-to-face phase.	22 February 2015	
Breakdown of participant effort time	Module Component	Estimated Time / hours = 45min
	Online lectures, seminars, tutorials, for a, homework preparation	28 hours
	compulsory reading of primary literature	7 hours
	Face-to-face lectures, seminars, discussions	22 hours (over 5 days)
	Face-to-face technical demonstrations	4,67 hours
	Face-to-face laboratory/clinical exercises incl. data analysis and result presentation	19 hours
	Total participant effort time (w/o assessment)	80,67 hours

PRE-REQUISITES FOR THE MODULE	
<p>Minimum entry qualifications, training and years of experience for all modules</p> <p>Same for all modules</p>	<p>EQF Level 7 in Medical Physics (MSc Medical Physics or equivalent)</p> <p>1 year equivalent clinical training in D&IR for clinical Medical Physicists</p> <p>1 year equivalent Industry/Radiation Authority experience for Industry/Radiation Authority personnel.</p>
<p>Assumed previous KSC for all modules from the 'Inventory of Learning Outcomes for the MPE in Europe' (Annex I of the 'European Guidelines on the MPE')</p> <p>Same for all modules</p>	<p>GENERIC SKILLS : Generic Skills Required at EQF level 7</p> <p>KSC FOR THE MPE AS PHYSICAL SCIENTIST: All Knowledge learning outcomes to EQF level 7</p> <p>KSC FOR THE MPE AS A HEALTHCARE PROFESSIONAL: All Knowledge learning outcomes to EQF level 7</p> <p>KSC FOR THE MPE AS EXPERT IN CLINICAL MEDICAL RADIOLOGICAL DEVICES & RADIATION PROTECTION: All Knowledge learning outcomes to EQF level 7</p> <p>KSC SPECIFIC FOR THE MPE IN DIAGNOSTIC & INTERVENTIONAL RADIOLOGY: All Knowledge learning outcomes to EQF level 7</p> <p>The Skills and Competences included in the IAEA document 'Clinical Training of Medical Physicists Specializing in Diagnostic Radiology' (IAEA Training Course Series, 47, 2010) to EQF level 7.</p>
<p>Assumed previous KSC for this modules from the 'Inventory of Learning Outcomes for the MPE in Europe' (Annex I of the 'European Guidelines on the MPE')</p>	<p>Generic:</p> <p><u>Instrumental:</u></p> <ul style="list-style-type: none"> Retrieve information from different sources. (1) Analyze and synthesize. (2) Communicate effectively (orally and in writing) in two European languages. – in this case one of the languages must be English (6) <p><u>Interpersonal:</u></p> <ul style="list-style-type: none"> Communicate orally and in writing with both experts in the field and non-experts. (1) Work productively in both mono-disciplinary and multi-disciplinary teams. (5) <p><u>Systematic:</u></p> <ul style="list-style-type: none"> Learn autonomously and take responsibility for one's own learning. (4) Apply research skills and use published evidence to develop and improve the quality of one's own practice. (6) Seek advice when a task is outside one's ability. (8) Assume responsibility for one's own actions (12) <p>MPE as Physical Scientist:</p> <p><u>Knowledge:</u></p> <ul style="list-style-type: none"> List the fundamental quantities and dimensions of physics, including use in checking consistency of equations. (K1)

	<p>List the common fundamental and derived constants of physics. (K2)</p> <p>List the base and derived SI units. (K3)</p> <p>Describe the band theory of solids with particular emphasis on semiconductors. (K12)</p> <p>List and describe the basic characteristics of common electronic components and integrated circuits. (K16)</p> <p>Describe the general design of a measuring instrument (K17)</p> <p>Utilize the ISO international vocabulary of metrology (VIM). (K18)</p> <p>Discuss the principles and processes of physics research. (K44)</p> <p><u>Skills:</u></p> <p>Manage the acquisition, editing, analysis, interpretation, presentation, and reporting of measurement data. (S1)</p> <p>Design and evaluate systems for the rigorous and safe conduct of physical measurements and experiments. (S5)</p> <p><u>MPE Healthcare Professional:</u></p> <p><u>Knowledge:</u></p> <p>Explain the role of Medical Physics Services in healthcare. (K3)</p> <p>Utilise accurate medical terminology in communication with other healthcare professionals. (K4)</p> <p><u>Competence:</u></p> <p>Practise responsibly within the legal, regulatory and ethical boundaries of the profession. (C1)</p> <p>Maintain fitness to practise in an autonomous manner. (C2)</p> <p>Collaborate with other healthcare professionals, support staff and service users, relatives, carers and comforters within own area of medical physics practice. (C3)</p> <p>Take responsibility for the management of own workload to ensure effective and efficient input to the work of the healthcare team in own area of medical physics practice. (C4)</p> <p>Assume responsibility to ensure that all activities are based on current best evidence or own scientific research when the available evidence is not sufficient. (C11)</p> <p>Take responsibility to maintain one's knowledge and skills current through an appropriate continuous professional development programme (C12)</p> <p><u>MPE Clinical Medical Radiological Devices & Radiation Protection:</u></p> <p><u>Knowledge:</u></p> <p>Explain quantitatively using biological models the beneficial and/or adverse biological effects of ionizing radiations and the various physical agents associated with medical devices, the factors influencing the magnitude of the biological effect and the way these can be manipulated to improve clinical outcomes e.g., in the case of ionizing radiation this would include radiobiological models, radiation epidemiology, mutagenesis, carcinogenesis (including leukaemogenesis), genetic effects on offspring from irradiation of gametes, teratogenic effects on the conceptus, skin effects, eye cataracts, cell survival curves, linear-quadratic model, absorbed dose, type of radiation (RBE, radiation weighting factor), tissue radiosensitivity (LET, RBE, tissue weighting factor), dose rate, presence of radiosensitisers, oxygen and radioprotectors, age, dose-effect relationships. (K4)</p>
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	<p>Explain the application of the terms deterministic/stochastic, early/late and teratogenic/genetic effects in relation to each physical agent. (K5) – with respect to ionizing radiation</p> <p>Define and explain the dosimetric quantities used to assess adverse biological effects for ionizing radiation. (K8)</p> <p>Explain the relationship between the various dosimetric quantities used (e.g., between energy fluence, kerma and absorbed dose for photon beams including the concept of charged particle equilibrium). (K10)</p> <p>List and explain statutory and institutional roles of Medical Physics Services with respect to Occupational and Public Safety / Risk Management in own area of medical physics practice <i>when there is an impact on medical exposure or own safety</i>. (K35)</p> <p>Describe the possible adverse biological effects (including mechanism) to workers / public from ionizing radiations (and other physical agents if appropriate) including the factors impacting the magnitude of the biological effect. (K36)</p> <p>Explain how sites and facilities are designed to ensure protection of workers and the general public. (K41)</p> <p>Describe and explain the procedures for the prevention, investigation and handling of adverse incidents with respect to workers/public in own area of medical physics practice. (K42)</p> <p>Explain the roles of occupational / public safety personnel associated with ionizing radiations and other physical agents such as Radiation Protection Expert and Radiation Protection Officer as defined in European, national and local legislation / documentation. (K46)</p> <p>Explain the scope, objectives, structure and content of formal systems of work ('local rules'). (K47)</p> <p>Explain in quantitative terms the various means of dose reduction for external radiation (source strengths, exposure times, distance, shielding) and internal radionuclides with respect to occupational / public safety. (K48)</p> <p>State current dose limits and constraints for workers / public. (K49)</p> <p>Explain the purpose and practical implementation of formal systems of work ('local rules') with regard to safety in own area of medical physics practice. (K58)</p> <p>Explain data warehousing for archiving and storage and relevant legislation regarding time such information must be kept. (K70)</p> <p>List and explain statutory and institutional requirements for Medical Physics Services in own area of medical physics practice with respect to Clinical Involvement. (K80)</p> <p>List and explain statutory and institutional requirements for Medical Physics Services in own area of medical physics practice with respect to Expert Consultancy. (K114)</p> <p>Explain the role of a consultant (K115)</p> <p>Explain the role of scientists as consultants in healthcare. (K116)</p> <p>List statutory and institutional requirements for Medical Physics Services with respect to the education and training of healthcare professionals (including Medical Physics trainees) in own area of medical physics practice (K119)</p> <p>Discuss the application of the principles of knowledge transfer to the case of healthcare professionals. (K120)</p> <p>Discuss methods for developing and delivering ionizing radiations and other physical agents education and training learning outcomes for addressing the learning needs of specific healthcare professionals in specific clinical environments (K122)</p> <p><u>Skills:</u></p> <p>Apply the general concepts, principles, theories and practices of physics to the solution of clinical problems concerning the</p>
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	<p>optimised clinical use of medical devices and safety / risk management with respect to associated ionizing radiations and other physical agents (S1)</p> <p>Use the general concepts, principles, theories and practices of physics to analyze the research literature concerning the optimised use of medical devices and safety / risk management with respect to ionizing radiations and other associated physical agents. (S2)</p> <p>Select and use instruments for dosimetric quantities for the various types of ionizing radiations and other physical agents for patients, workers and public in own area of medical physics practice. (S8)</p> <p>Interpret and apply local occupational protection rules as applicable to medical device QC procedures. (S38)</p> <p><u>MPE in Diagnostic & Interventional Radiology:</u></p> <p><u>Knowledge:</u></p> <p>List statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Scientific Problem Solving Service. (K1)</p> <p>List the common imaging modalities (general projection x-ray imaging (DDR, CR and film-screen where this is still valid), chest systems, mammography, dental systems (intra-oral, OPG, cephalometric systems), mobile, flat panel / image intensifier fluoroscopes including C-arms, interventional systems, tomosynthesis, paediatric systems, radiostereometric (RSA) systems, stereotactic 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 specialised use such as paediatric. (K2)</p> <p>List statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to patient /occupational / public Ionizing and Non-ionizing Radiation Dosimetry Measurements. (K51)</p> <p>Define and explain methods of measurement of occupational / public dose indicators suitable for ensuring adherence to exposure limit values and dose constraints: (K52)</p> <ul style="list-style-type: none"> - x-ray imaging: ambient $H^*(10)$, directional $H'(0.07, \text{angle})$ and personal dose equivalents i.e., depth dose equivalent $HP(10)$ and skin dose equivalent $HP(0.07)$ <p>List statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Occupational & Public Safety / Dose Optimization <i>when there is an impact on medical exposure or own safety.</i> (K68)</p> <p>Explain radiobiological dose-effect relationships relevant to Diagnostic and Interventional Radiology with respect to occupational/public safety including discussion of the physical and biological background, response of tissues to radiation on molecular, cellular and macroscopic level, models of radiation induced cancer and hereditary risks and radiation effects on humans in general, children and the conceptus. (K71)</p> <p>For each imaging modality, explain the physical principles underpinning the use of protective barriers, accessories and personal protective equipment with regard to occupational/public safety. (K72)</p> <p>For each imaging modality list and explain the protocol design variables (including appropriate device settings, accessories, safety measures) which occupational/public safety. (K73)</p>
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	<p>Explain the principles of time, distance and shielding with respect to external radiation exposure, and the practical application of these principles to the radiation safety of the worker and public in Diagnostic and Interventional Radiology. (K74)</p> <p>Define and describe the role of the RPE and RPO in the establishment and management of systems for radiation safety in Diagnostic and Interventional Radiology. (K75)</p> <p>For each imaging modality define and explain appropriate occupational/public ionizing radiations and other physical agents dose monitoring quantities. (K76)</p> <p>Explain the use of occupational / public dose indicators used in x-ray imaging: ambient $H^*(10)$, directional $H'(0.07, \text{angle})$ and personal dose equivalents i.e., depth dose equivalent $HP(10)$ and skin dose equivalent $HP(0.07)$. (K77)</p> <p>Explain the special requirements with respect to occupational radiation protection in fluoroscopy (e.g., particularly in paediatrics and interventional procedures (K78)</p> <p><u>Further Knowledge:</u></p> <p>Explain the meaning of calibration (relative, absolute, calibration coefficients...), traceability and primary / secondary standards.</p> <p>Describe in detail and quantitatively the properties of ionising radiations to be found in the healthcare environment.</p> <p>Explain quantitatively using biological models the beneficial and/or adverse biological effects of ionizing radiations, the factors influencing the magnitude of the biological effect.</p> <p>Explain quantitatively and in detail the interactions with organic matter of ionising radiations at the molecular, cellular, tissue and macroscopic levels in relation to occupational risks.</p> <p>Explain the roles of occupational safety personnel associated with ionizing radiations and other physical agents such as Radiation Protection Expert and Radiation Protection Officer as defined in European, national and local legislation / documentation.</p> <p>State current dose limits and constraints for workers.</p> <p>Define and explain the principles of quality, quality assurance, quality control, performance indicators, constancy testing, quality control tests, test frequency, tolerances, and action criteria with respect to medical devices.</p> <p><u>Further Skills:</u></p> <p>Convert dosimetry quantities measured in air or other medium to relevant dosimetric quantities in tissue.</p> <p>Apply the general concepts, principles, theories and practices of physics to the solution of clinical problems concerning the optimised clinical use of medical devices and safety / risk management with respect to associated ionizing radiations and other physical agents.</p>
<p>Pre-requisite EUTEMPE-RX online summary modules for all modules</p>	<p>None required</p>
<p>Additional pre-requisite EUTEMPE-RX online summary</p>	<p>None required</p>

modules for <i>this</i> module	
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Different for each module.

MODULE CONTENT: AIM and SUMMARY LEARNING OUTCOMES																					
Aim	<p>This module will offer the future MPE a comprehensive view on the field of personnel dosimetry. The participants will acquire knowledge, skills and competences necessary to set up and manage a personnel dosimetry system in a large or university hospital. They will be confronted with chances and limitations of different dosimetric approaches, will discuss a reasonable use of systems for different clinical exposure situations and learn how to motivate the use of personnel dosimetry systems. The use of personnel dosimetry data in teaching scenarios to optimize radiation protection to the staff and its relation to patient exposure will be studied. In the light of the new knowledge of radiation based hazard to the eye lens dosimetric approaches to estimate exposures to the lens and extremities will be addressed and their limitations will be discussed.</p>																				
<p>Learning Outcomes (10 – 15 learning outcomes which provide an overview of the KSC addressed in the module)</p>	<table border="0"> <tr> <td style="vertical-align: top;">MPE12.01</td> <td>Take responsibility for the specification and selection of dosimetry systems for personnel dosimetry.</td> </tr> <tr> <td style="vertical-align: top;">MPE12.02</td> <td>Take responsibility for the clinical dosimetry of the personnel, including education of the personnel in diagnostic and interventional radiology</td> </tr> <tr> <td style="vertical-align: top;">MPE12.03</td> <td>Assess, evaluate and optimise dose of the personnel in clinical situations in diagnostic and interventional radiology.</td> </tr> <tr> <td style="vertical-align: top;">MPE12.04</td> <td>Apply knowledge into further research and development in dosimeters and optimization techniques for further dose reductions of the personnel.</td> </tr> <tr> <td style="vertical-align: top;">MPE12.05</td> <td>Discuss the role of the MPE (D&IR) in health technology assessment (HTA), innovation and expert consultancy.</td> </tr> <tr> <td style="vertical-align: top;">MPE12.06</td> <td>Correlate occupational and medical exposures balancing occupational risk and patient needs</td> </tr> <tr> <td style="vertical-align: top;">MPE12.07</td> <td>Have a well-founded understanding of dosimetry systems in use, balancing their strengths and limitations</td> </tr> <tr> <td style="vertical-align: top;">MPE12.08</td> <td>Manage inter-professional issues in D&IR.</td> </tr> <tr> <td style="vertical-align: top;">MPE12.09</td> <td>Implement safety culture in their management practice.</td> </tr> <tr> <td style="vertical-align: top;">MPE12.10</td> <td>Interpret the significance of liaising with the Radiation Protection Expert</td> </tr> </table>	MPE12.01	Take responsibility for the specification and selection of dosimetry systems for personnel dosimetry.	MPE12.02	Take responsibility for the clinical dosimetry of the personnel, including education of the personnel in diagnostic and interventional radiology	MPE12.03	Assess, evaluate and optimise dose of the personnel in clinical situations in diagnostic and interventional radiology.	MPE12.04	Apply knowledge into further research and development in dosimeters and optimization techniques for further dose reductions of the personnel.	MPE12.05	Discuss the role of the MPE (D&IR) in health technology assessment (HTA), innovation and expert consultancy.	MPE12.06	Correlate occupational and medical exposures balancing occupational risk and patient needs	MPE12.07	Have a well-founded understanding of dosimetry systems in use, balancing their strengths and limitations	MPE12.08	Manage inter-professional issues in D&IR.	MPE12.09	Implement safety culture in their management practice.	MPE12.10	Interpret the significance of liaising with the Radiation Protection Expert
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MODULE CONTENT: TARGET KSC TO BE DEVELOPED TO EQF LEVEL 8
From the 'Inventory of Learning Outcomes for the MPE in Europe' (Annex I of the 'European Guidelines on the MPE')

<p>KSC targeted in <i>all</i> modules</p> <p>These learning outcomes are common to and permeate <i>all</i> modules, although to a varying degree according to the topic of the module.</p>	<p>GENERIC SKILLS : All 'Generic Skills Required at EQF level 8'</p> <p>KSC FOR THE MPE AS PHYSICAL SCIENTIST: All Skills and Competences to EQF level 8</p> <p>KSC FOR THE MPE AS A HEALTHCARE PROFESSIONAL: All Skills and Competences to EQF level 8</p> <p>KSC FOR THE MPE AS EXPERT IN CLINICAL MEDICAL RADIOLOGICAL DEVICES & RADIATION PROTECTION (AND OTHER PHYSICAL AGENTS AS APPROPRIATE): All KSC for Scientific Problem Solving Service to EQF level 8</p> <p>KSC SPECIFIC FOR THE MPE IN DIAGNOSTIC & INTERVENTIONAL RADIOLOGY: All KSC for Scientific Problem Solving Service to EQF level 8</p>
<p>PRIMARY KSC targeted in <i>this</i> module</p> <p>These are the KSC which would be developed to Level 8 during this module. These should be mostly Skills and Competences. However, Knowledge learning outcomes should also be included when the knowledge normally acquired during Level 7 programmes is insufficient for the development of the skills and competences to level 8.</p> <p>The KSC codes from the 'European Guidelines on the MPE' should be inserted for easy reference.</p>	<p><u>KSCs from the MPE as Physical Scientist:</u></p> <p><u>Knowledge:</u></p> <p>List and explain the specifications of measuring instruments including accuracy, SNR, precision, range of measurement, resolution, reliability (repeatability, reproducibility, consistency, stability, ruggedness), sensitivity, specificity, linearity, response time. (K19)</p> <p><u>KSCs from the MPE as a Healthcare Professional:</u></p> <p><u>Knowledge:</u></p> <p>Explain and discuss the concepts of quality, safety / risk and cost-effectiveness as applied to healthcare. (K6)</p> <p>Explain briefly European and national legal frameworks, regulations, guidelines and codes-of-practice impacting the practice of other professions with whom the MPE interacts (K10) – with respect to personnel dosimetry</p> <p><u>Skills:</u></p> <p>Communicate effectively clinical information, advice, instruction and professional opinion to patients, colleagues, other healthcare professionals, support staff, service users, relatives, carers, comforters and volunteers in medical research within own area of medical physics practice using appropriate terminology. (S1)</p> <p>Make best use of available resources in the interest of patients and society. (S5) – with respect to personnel dosimetry</p>

Competence:

Organise the various aspects of the routine service within own area of medical physics practice. (C5)

Take responsibility for making the best use of available resources to provide optimum healthcare to patients and members of society. (C9)

KSCs from the MPE as Expert in Clinical Medical Radiological Devices & Radiation Protection:

Knowledge:

Define operational quantities (including units and inter-relationships) used in personal dosimetry e.g., ambient $H^*(10)$, directional $H'(0.07, \text{angle})$ and personal dose equivalents i.e., depth dose equivalent $HP(10)$ and skin dose equivalent $HP(0.07)$ for external photon radiation and explain the method used for their measurement / calculation. (K11)

Describe and explain in detail and quantitatively the structure, operation and advantages / disadvantages of the various types of personal dosimeters and area monitors available for the various types of ionising radiation including criteria for selection (e.g., accuracy, precision, uncertainties, linearity, any dose rate / energy / directional dependence, spatial resolution, physical size, read out convenience and convenience of use), management, calibration, traceability (including international traceability framework) and user protocols (in the case of ionizing radiation dosimetry include cavity theory). (K12)

Define and measure or calculate the operational quantities used in personal dosimetry (e.g., ambient, directional and personal dose equivalents at recommended depth). (K44)

Explain the possible impact of human factors with regard to occupational / public safety in use of medical devices and associated ionizing radiations and other physical agents. (K45)

Describe the requirements for, and the practical implementation of, appropriate systems for the monitoring of radiation dose to the worker, including extremity doses and dose limits for pregnant and lactating workers, and young workers; and for the public; including selection, management and calibration of devices used to measure such doses, dose records and techniques for dose measurement. (K54)

Explain why the holistic development of a service depends on the quality assurance of the parts. (K105)

Describe the general role of the MPE as consultant in own area of medical physics practice. (K117)

Skills:

Interpret the results of dosimetry measurements. (S10)

Maintain calibration of dosimetry instruments. (S11)

	<p>Implement cross-calibration procedures for dosimetry instruments. (S12)</p> <p>Convert dosimetry quantities measured in air or other medium to relevant dosimetric quantities in tissue. (S13)</p> <p>Assess occupational risk from given procedures in own area of medical physics practice from ionizing radiations and other physical agents using measured occupational dose data and dose-effect relationships. (S25)</p> <p>Carry out a risk audit with respect to occupational / public safety from ionizing radiations and other physical agents in own area of medical physics practice. (S26)</p> <p>Participate in development of service quality and cost-effectiveness in own area of medical physics practice. (S55)</p> <p>Apply MPE consultancy skills to specific scenarios in own area of medical physics practice. (S65)</p> <p><u>Competence:</u></p> <p>Take responsibility for dosimetric investigations and the supervision of dosimetry measurements. (C11)</p> <p>Take responsibility for statutory and institutional requirements for Medical Physics Services with respect to Development of Service Quality and Cost-Effectiveness in own area of medical physics practice, whilst being aware that improvement of the service as a whole depends on the inputs of other healthcare professionals. (C55)</p> <p>Take responsibility for the education of healthcare professionals (including Medical Physics trainees) regarding protection from ionizing radiations and other physical agents including the use of personal dose monitors and personal protection equipment. (C69)</p> <p><u>KSCs from the MPE in Diagnostic & Interventional Radiology:</u></p> <p><u>Skills:</u></p> <p>For each imaging modality, identify and carry out appropriate patient / occupational / public safety related dosimetric measurements and calculations. (S12)</p> <p>For each modality apply local European laws, regulations, recommendations and standards related to occupational/public safety. (S23)</p> <p>Verify that radiation protection and risk management is in compliance with guidelines, directives, and legislation (including dose limits) /S24)</p> <p><u>Competence:</u></p> <p>Take responsibility for statutory and institutional requirements for Medical Physics Services with respect to Ionizing and Non-</p>
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	<p>ionizing Radiation Dosimetry Measurements. (C3)</p> <p>For each imaging modality, take responsibility for the measurement of appropriate patient / occupational / public safety related dosimetric monitoring quantities (C4)</p> <p>Take responsibility for statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Development of Service Quality - Cost Effectiveness. (C28)</p>
<p>SECONDARY KSC targeted in this module (EQF Level 8)</p> <p>These are the KSC that are included in the module but would be given less attention owing to time constraints.</p> <p>Please insert the KSC code from the 'European Guidelines on the MPE' project KSC Inventory.</p>	<p>Generic Skills:</p> <p>Demonstrate a systematic understanding of a field of study and mastery of the skills and methods of research associated with that field. (1)</p> <p>Find, select and define problems of interest. – in this case in the field of personnel dosimetry (2)</p> <p>Demonstrate critical analysis, evaluation and synthesis of new and complex ideas. (8)</p> <p>Promote within professional contexts, technological, social or cultural advancement in a knowledge based society. (10)</p> <p>KSCs from the MPE as Physical Scientist:</p> <p><u>Knowledge:</u></p> <p>Explain the meaning of calibration (relative, absolute, calibration coefficients...), traceability and primary / secondary standards. (K20)</p> <p>Explain quantitatively the following characteristics of ionizing radiation sensors / detectors: pulse height spectrum and energy resolution, counting curves and plateau, detection efficiency and energy response, dead time, detection threshold and temporal resolution. (K22)</p> <p>Explain the concept of bias in measurement and ways to avoid it. (K40)</p> <p><u>Competences:</u></p> <p>Manage the conduct of experimental work autonomously and in a safe manner. (C1) – in the field of personnel dosimetry.</p> <p>Assume responsibility to autonomously: (C2) – in the field of personnel dosimetry.</p> <p>- List a set of research objectives worthy of attention and which are realizable given the available resources.</p>

- Write a literature review article concerning the area of interest.
- Realize the research objectives by integrating and applying knowledge and skills.
- Communicate clearly results to peers (in the form of notes, resumes, reports, poster, journal/conference article, oral presentation) at local and international meetings and for research journals.
- Defend results in front of peers.

KSCs from the MPE as a Healthcare Professional:

Knowledge:

Explain and discuss ethical and legal issues in healthcare relevant to the scope of the profession (e.g., research ethics, data protection, privacy, dignity, ethical governance. (K7) – with respect to personnel dosimetry

Discuss those aspects of healthcare psychology and sociology relevant to the profession. (K8) – with respect to personnel dosimetry

Skills:

Establish the necessary communication links and relations with other healthcare professionals and organizational units related to own area of medical physics practice. (S2)

Competence:

Take responsibility for appropriate behaviour towards colleagues, patients and relatives as stipulated by organizational policies and national legislation. (C7)

Assume responsibility for timely action (within own limitations) to prevent and respond to adverse events. (C10)

KSCs from the MPE as Expert in Clinical Medical Radiological Devices & Radiation Protection:

Knowledge:

Use physics, concepts, principles and theories to describe in detail and quantitatively, the structure, functioning, characteristics, strengths and limitations and use of the medical devices used in own area of medical physics. (K2)

Explain the principles of occupational risk audit and management, hazard prevention and emergency preparedness as applied to ionizing radiations (and other physical agents if approp) associated with the use of medical devices in own area of medical physics practice. (K37)

	<p>Explain how the principles of justification, optimization (including ALARA), and risk limitation are used for occupational and public protection from the deleterious effects of ionizing radiations and other physical agents. (K 39)</p> <p>Describe the process and practical implementation of occup./ public risk assessments in own area of medical physics practice, using techniques for the qualitative and quantitative assessment of risk. (K50)</p> <p>Describe suitable processes for the reporting of radiation incidents involving workers / members of the general public in the context of own area of medical physics practice, using root cause analysis and/or other tools to determine the underlying cause(s). (K53)</p> <p>Explain how the application of good radiation safety practice and the use of appropriate personal protective equipment minimises worker and public doses in medicine (K55)</p> <p>Explain protocol optimization principles in own area of medical physics practice. (K89)</p> <p>Explain the principles of business, strategic planning and cost effectiveness in the case of Medical Physics Services. (K103)</p> <p>Define and explain the principles of quality, continuous quality improvement, quality audit and total quality management systems as applied to aspects of clinical audits involving medical devices and associated ionizing radiations and other physical agents. (K104)</p> <p>Explain why the development of service quality for an area of medical practice requires input from various healthcare professionals. (K106)</p> <p>Describe responsibilities of other healthcare professionals involved in QA activities in own area of medical physics practice (K107)</p> <p>Define quality objectives in own area of medical physics practice. (K109)</p> <p>Describe the institutional framework of QA activity and regulation in own area of medical physics practice. (K110)</p> <p><u>Skills:</u></p> <p>Use physics research skills to develop the experimental evidence base for the optimal use of medical devices and safety / risk management from associated ionizing radiations and physical agents when present evidence is insufficient. (S3)</p> <p>Use the general concepts, principles, theories and practices of physics to ensure effective and safe practice in own area of medical physics practice. (S4)</p> <p>Use the general concepts, principles, theories and practices of physics for the transfer of new medical devices and associated techniques to the clinical environment in an effective, safe and economical manner. (S5)</p> <p>Perform occupational / public risk assessment based on facility survey and estimated / measured dosimetry data in own area of medical physics practice. (S24)</p>
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	<p>Evaluate facilities/systems/procedures in terms of occupational / public safety from ionizing radiations and other physical agents in own area of medical physics practice. (S27)</p> <p>Define quality objectives in own area of medical physics practice. (S56)</p> <p>Define, measure and optimize appropriate quality indicators in own area of medical physics practice. (S57)</p> <p>Set up a service quality development strategy for own area of medical physics practice. (S58)</p> <p>Apply the principles of business, strategic planning and cost effectiveness in own area of medical physics practice. (S60)</p> <p>Prepare effective and efficient modes of knowledge transfer activities specific to the specific learning needs of specific healthcare professionals in specific clinical environments in conjunction with the leaders of the respective healthcare professions. (S68)</p> <p><u>Competence:</u></p> <p>Take responsibility for statutory and institutional requirements for Medical Physics Services in own area of medical physics practice with respect to Scientific Problem Solving Service. (C1)</p> <p>Take responsibility for the setting-up and organization of a Medical Physics Service in own area of medical physics practice. (C2)</p> <p>Take responsibility for using the general concepts, principles, theories and practices of physics to analyze the research literature concerning the optimal use of medical devices and management of risk from associated ionizing radiations and other physical agents and to transfer relevant published research results to the clinical environment in own area of medical physics practice. (C4)</p> <p>Take responsibility for statutory and institutional requirements for Medical Physics Services in own area of medical physics practice with respect to Dosimetry Measurements. (C7)</p> <p>Equip an appropriate laboratory for the measurement of dosimetric quantities for the various types of ionizing radiations and physical agents for patients, workers and public in own area of medical physics practice. (C8)</p> <p>Take responsibility for the handling, management, calibration and maintenance of dosimetry instruments in own area of medical physics practice. (C10)</p> <p>Take responsibility for statutory and institutional requirements for Medical Physics Services in own area of medical physics practice with respect to Occupational and Public Safety / Risk Management <i>when there is an impact on medical exposure or own safety.</i> (C26)</p> <p>Participate in the design and implementation of QA systems in own area of medical physics practice. (C57)</p> <p>Take responsibility for statutory and institutional requirements for Medical Physics Services in own area of medical physics practice with respect to Expert Consultancy including responsibility for associated ethical issues commensurate with level of</p>
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personal expertise. (C63)

Take responsibility for the education of healthcare professionals (including Medical Physics trainees) regarding the optimised clinical use of medical devices and safety from ionizing radiations and other physical agents in specific clinical environments in own area of medical physics practice. (C68)

MPE in Diagnostic & Interventional Radiology:

Knowledge:

For each imaging modality list and explain target occupational/public safety outcomes with respect to hazards from ionizing radiations and other physical agents. (K69)

Explain the practical application of ALARA to promote the radiation safety of the worker and public in Diagnostic and Interventional Radiology. (K70)

List statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Development of Service Quality and Cost-Effectiveness. (K108)

Explain why development of service quality and cost-effectiveness in Diagnostic and Interventional Radiology necessitates the participation of the various professions. (K109)

Explain the role of the various professions involved in Diagnostic and Interventional Radiology with respect to the development of service quality and cost-effectiveness. (K110)

List statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Expert Consultancy. (K111)

List statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Education of Healthcare Professionals (including Medical Physics trainees). (K113)

Skills:

Use radiobiological dose-effect relationships relevant to Diagnostic and Interventional Radiology to estimate occupational/public. (S22)

Competence:

Take responsibility for statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Scientific Problem Solving Service. (C1)

Take responsibility for statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Occupational / Public Safety /Dose Optimization *when there is an impact on medical exposure or own*

	<p><i>safety. (C11)</i></p> <p>Take responsibility for statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Expert Consultancy. (C29)</p>
<p>NEW KSC which are NOT INCLUDED in the 'Inventory of Learning Outcomes for the MPE in Europe'.</p>	<p><u>Knowledge:</u></p> <ul style="list-style-type: none"> List and explain the statutory and institutional requirements of Medical Physics Services with respect to dosimetric measurements. Define patient dosimetric quantities for each clinical procedure in own area of medical physics practice and explain the method used for their measurement / calculation. Explain the principles of biological monitoring / dosimetry. Explain the possible impact of human factors with regard to occupational safety in use of medical devices and associated ionizing radiations. <p><u>Skills:</u></p> <ul style="list-style-type: none"> Select and use instruments for dosimetric quantities for the various types of ionizing radiations and other physical agents for patients, workers and public in own area of medical physics practice. Develop rigorous dosimetry protocols in own area of medical physics practice. Implement cross-calibration procedures for dosimetry instruments. Convert dosimetry quantities measured in air or other medium to relevant dosimetric quantities in tissue. Educate the personnel in the use of personnel dosimeters and optimization of their radiation exposure. <p><u>Competences:</u></p> <ul style="list-style-type: none"> Take responsibility for the selection, acceptance testing, commissioning and quality control of instruments for the measurement of dosimetric quantities for ionizing radiations. Liaise with the Radiation Protection Expert.

OUTLINE TEACHING PLAN

Final detailed teaching plan to be delivered to the QAC electronically 30 days before the start of the online phase of the module

Online phase

The online component will consist of a series of online lectures and compulsory readings dealing with the subjects listed below:

1. Epidemiology:
 - a. Epidemiological theory, radiation effects
 - b. Deterministic effects relevant for extremity and eye lens
 - c. Low dose effects
 - d. Risk comparison
2. Dosimetry
 - a. Interaction of ionizing radiation with matter
 - b. Definition of relevant dosimetric quantities (e.g. kerma, $H_p(10)$, $H^*(0.07)$, $H_p(3)$)
 - c. Physics and technic used in dosimeters,
 - d. Measured quantities – from kerma to H_p quantities
 - e. TLD dosimetry (online interactive glow curve)
 - f. Electronic Personal Dosimeter (EPD)
3. Measurement uncertainties
 - a. GUM
 - b. Approaches to assessment of uncertainties
 - c. Application to clinical measurement settings
4. Legal background
 - a. EURATOM directives, national legislation
 - b. Realization in Germany
 - c. ICRP
 - d. Administrative vs. On-site dosimetry
 - e. Supervision of pregnant and assisting persons
5. Exposure situations
 - a. Challenges in the assessment of doses in different clinical scenarios
 - b. Workflow and exposure situations in different clinical departments (e.g. general radiology, ICU, pediatrics, traumatology, fluoroscopy, endoscopy, urology, neurosurgery, angiography, cardiology, vascular surgery, CT-interventions)
 - c. Equipment used and characteristics of different workplaces – exceptionally exposed body parts
6. Software tools
 - a. Basic assumptions / underlying calculations of simulation packages
 - b. Simulation of radiation in the surrounding of X-ray sources

	c. Example cases
Face-to-Face Phase	<p>Within the onsite phase the theoretical topics will be repeated and extended by lectures being held by experts in the individual field. The main part of the onsite phase, however, is related to gain practical knowledge in the use of the different dosimetric systems, understand their limitations and to investigate the doses and exposure conditions at different work places within hospitals. Further, extended room for discussions on different approaches and challenges associated with personnel dosimetry is provided.</p> <ol style="list-style-type: none"> 1. Epidemiology: <ol style="list-style-type: none"> a. Epidemiological background of personnel dosimetry with special focus on low dose effects b. Epidemiological basis of eye lens surveillance 2. Dosimetry: <ol style="list-style-type: none"> a. Repetition and extended discussion on basic dosimetry: a) protection quantities and measurands; b) challenge of the assessment of conceptually not measurable quantities; c) definition of measurands / link to reality; d) film dosimetry; e) active / passive dosimeters b. TLD dosimetry c. OSL dosimetry d. Active dosimeter and new developments in the field of personnel dosimetry e. Assessment of errors f. Setup, conduction, analysis and presentation of studies on the response characteristics of EPD in different exposure situations g. Setup, requirements and challenges of legal dosimetry; conduction of legal dosimetry h. Discussion of different approaches to measure the dose of the lens of the eye 3. Clinical exposure situations <ol style="list-style-type: none"> a. Short repetition and extension of the online part dealing with this topic b. Real time dosimetry and its applications c. Schedule and d. Setup, conduction, analysis and presentation of studies to assess the exposure of the staff in clinical exposure situations 4. Legal background <ol style="list-style-type: none"> a. Comparison of different approaches of legal dosimetry in different European countries b. Dosimetry approaches (double dosimeter) c. Surveillance of staff with annual doses < 1 mSv 5. Software Tools <ol style="list-style-type: none"> a. Hands on practice with the simulation tools presented in the online phase b. Chances of a joint analysis of staff and patient doses 6. Motivation / communication of personnel dosimetry <ol style="list-style-type: none"> a. Approaches to communicate and motivate personnel dosimetry

READING LIST (APA format)

Final List to be delivered to the QAC electronically 30 days before the start of the online phase of the module

Required Pre-Module Reading list	Not specified
Required Within Module Reading list	Provided seperately
Suggested Post-Module Reading list	Not specified

TWO EXEMPLAR ASSESSMENT QUESTIONS

To be delivered to the QAC electronically 30 days before the start of the online phase of the module

Question 1

Question 2

EFOMP ACCREDITATION

To be delivered to the QAC electronically 30 days before the start of the online phase of the module

EFOMP accreditation certificate stating that the 'The module is appropriate for preparing Clinically Qualified Medical Physicists to achieve Medical Physics Expert status in Diagnostic and Interventional Radiology'

Please scan and paste a copy of the EFOMP accreditation certificate here.