Initial Certification in Medical Physics

Part 3 Oral Exam Content Guide

The oral examination is designed to test your knowledge and fitness to practice applied medical physics in the specified specialty(ies). You will be examined by five physics examiners, each of whom will ask one question from each of the five physics categories of the examination.

Medical Physics Oral Exam Categories

The categories below are used for the Part 3 Oral Exam in medical physics. The category descriptions are general descriptions of the content of each category. In any particular examination, the material from the categories is sampled. Additional material related to the categories may be included as the field evolves. These categories are used in all oral exams, for both first-time candidates and candidates who have previously taken the oral exam.

Conditioned Exams

Candidates who conditioned the oral exam in 2014 or earlier will continue to be examined in the category(ies) in which they were conditioned. (View the list of pre-2014 categories.) Candidates who are conditioned in 2015 and subsequent years will be examined in the new categories.

CONTENT GUIDE

The content of all ABR exams is determined by a panel of experts who select the items based on a content guide that the ABR publishes. The content guides are assembled using guidance from medical physics organizations. The content guides are general documents, and individual exam items may not appear to be exactly congruent with the content listed in the guide. In addition, since there is only a limited number of items on any exam, selected items will only be a sample from the larger domain of the content guide.

DMP	Category Description
Radiography, mammography, fluoroscopy, and interventional imaging	• X-ray production, beam characteristics, interactions, and image-formation principles; • Types and characteristics of image detectors; • Clinical protocols for common imaging exams; • Fluoroscopy and interventional procedures, including acquisition parameters and dose-reduction strategies; • Image noise assessment and dose metrics for all projection imaging modalities; • Common artifacts, quality assurance, quality control, mammography accreditation, and MQSA standards
Computed tomography	• CT system design and principles of operation; image-acquisition protocols, including helical acquisition and tube current modulation techniques; • Cone beam geometry; • Post-processing protocols, multi-planar and volumetric reconstruction; • Quantitative CT; • Image noise assessment, statistics, dose metrics (CTDI, DLP, SSDE), and effective dose estimation; • Common CT artifacts, quality assurance, and CT accreditation program
MRI and ultrasound	• MR equipment, principles of magnetization, resonance, and excitation; • MR pulse sequences, localization, acquisition, and processing; • Ultrasound (US) principles, beam properties, acquisition methods, signal processing, and image display; • Doppler US and color flow imaging principles and operation; • Common artifacts for MRI and US, siting requirements for MRI, quality assurance, and accreditation for MRI and US
Informatics, image display, image fundamentals, professionalism and ethics	• Informatics infrastructure, standards, and patient security; • PACS-modality connectivity, workflow, display, and archive functions; • Image display requirements, characteristics, and calibration procedures; • Image processing techniques and qualitative data extraction; • Image fundamentals, sampling theory, and ROC analysis • Professionalism and ethics in clinical medical physics practice
Radiation biology, dosimetry, protection, and safety	• Radiation biology, radiation effects, and age/gender-specific risks; • Radiation protection principles, guidelines, and regulations; radiation dosimetry, detectors, standards, and units; • Radiation shielding design factors, barrier requirements, surveys, and reports; • Patient safety and error-prevention issues, including dose reduction, sentinel events, and MR- and US-specific safety issues
NMP	Category Description

Radiation protection, safety, professionalism and ethics	• Internal dosimetry, including MIRD (formalism), fetal dose, units; • Personnel safety, including facility surveys and occupational dose limites, radiation protection principals, personnel dosimetry; • Safety for the patient, family and public (including exposure pathways, breastfeeding, and pregnancy); • Shielding including facility design and personnel protection; • Regulations and regulatory bodies including medical event assessment, shipping and waste disposal, ALARA, time, distance and shielding, radiation surveys • Professionalism and ethics
PET and hybrids	• Radionuclide production and characteristics; • QC procedures including ACR/TJC/NEMA and acceptance testing, artifacts; • System principles, image fusion, random coincidences, scattered radiation, dead-time; • Quantitative PET including SUV; • Image reconstruction including attenuation correction, iterative reconstruction, filtered back projection
Single photon imaging systems including scintillation cameras, solid state cameras, and hybrids	• Radionuclide production and characteristics for SPECT and planar imaging; • QC procedures including ACR/TJC/NEMA and acceptance testing, artifacts; • System principles including scintillation cameras, solid state cameras, collimators, image fusion, system characteristics; • Dynamic imaging, renograms, cardiac function, ejection fraction, tracer kinetics, lung shunt fraction; • Image reconstruction including scanograms, attenuation correction, filters, edge enhancement, smoothing, unsharp masking, segmentation
Radiation measurements including dose calibrators, well counters, survey meters, thyroid probes	• Radioactivity measurement including dose calibrators, well counters, thyroid uptake probe, survey meters; • Statistics, minimum detectable activity; • Radiation detectors including survey meters, dead-time, personnel monitoring; • Quantitative measurements including calibration; • QC procedures including use of chi square, energy resolution, counting efficiency, geometry, linearity accuracy
Clinical procedures	• Radionuclide therapy including facilities, release criteria, radionuclide production; • PET & hybrids; • SPECT & hybrids including gamma cameras; • Radiation dosimetry including risk, radiation protection, and CT dose; • Radiopharmaceutical usage, thyroid imaging/uptake, informatics, display performance; misc.

TMP	Category Description
Radiation protection, patient safety, professionalism and ethics	• External beam and Brachytherapy shielding design, calculations, definitions, limits, procedures and regulations. • Radiation biology, dose equivalence and dose response. • Assuring patient safety through fault and error prevention, error identification, root cause analysis, quality assurance processes, staff training, and introduction of new technologies. • Regulatory guidance, material transport, event reporting, patient release, personnel monitoring, implanted patient devices, special conditions. • Professionalism and ethics
Patient-related measurements	• External beam planning and simulation: clinical treatment plans, identification of target volumes and organs at risk and respective doses, plan evaluation and optimization, use of beam modifiers. • Photon and Electron beam algorithms, dose calculations, beam characteristics and modeling, heterogeneity and extended distance corrections and MU calculations. • Brachytherapy (HDR, LDR) clinical plans, source characteristics, treatment applicators, dose calculation methods treatment volumes and target/organ doses. • Special procedures (e.g. SRS, SBRT, TBI, TSET)
Image acquisition processing and display	• Imaging for therapy simulation, planning and delivery. • Identification of relevant imaging modalities and their applications, reconstruction techniques, image acquisition parameters, planar and volumetric imaging, purpose and creation of reference, verification and localization images. • Image fusion and image registration techniques and applications. • Organ/target segmentation, definitions, nomenclature, identification of structures and methods of segmenting. • Data communication. • Equipment for imaging and basic imaging physics as it applies to therapy imaging.
Calibration, quality control, and quality assurance	• Absolute calibration protocols for external beam. • Quality assurance procedures for mechanical, dosimetric and safety characteristics of the delivery system, QA equipment, recommendations and requirements. • Treatment machine acceptance testing and commissioning, performance specifications, measurement equipment and techniques. • Brachytherapy (LDR and HDR) calibration and QA, commissioning, calibration, procedures, and equipment. • Photon beam definitions, beam characteristics and dependencies.
Equipment	• Therapy treatment head components, function and characteristics. • Design, characteristics, application and QA of ion chambers, TLD, OSLD, diodes, MOSFET, radiographic, and radiochromic film. • Therapy accelerator systems – design and operation of waveguide, power and control components.

	• Electrometers, water/tissue substitute materials and appropriate use, phantoms, beam- scanning systems, CT and MR simulators, test/QA equipment for imaging systems. • Proton therapy.