



The Hong Kong College of Radiographers and Radiation Therapists

Certification Examination of Computed Tomography (CT)

Syllabus

Objective

The objective of the Certification Examination of Computed Tomography (CT) is to provide a channel for Radiographers to attain the recognized standard in Computed Tomography to be admitted as a Member of the Hong Kong College of Radiographers and Radiation Therapists (HKCRRT) (Computed Tomography) MHKCRRT(CT)

Entry Requirements

- ◆ Being a Radiographer registered with the Hong Kong Radiographer's Board
- ◆ 5 years of post-registration working experience in medical imaging or radiation therapy
- ◆ A recognized Bachelor degree in medical imaging, radiation therapy or equivalent

Format of Certification Examination

150 Multiple Choice Questions covering basic principles and clinical applications of CT such as:

- ◆ CT system design and instrumentation (10%)
- ◆ CT image reconstruction and quality assurance (20%)
- ◆ Clinical application in CT imaging (30%)
- ◆ CT anatomy and pathology (20%)
- ◆ Advance CT imaging and processing technique (10%)
- ◆ CT contrast media and application (5%)
- ◆ Radiation safety and dose optimization technique in CT (5%)

Duration of Examination

3 hours

Syllabus of Examination

(A)CT system design and instrumentation

- ◆ Generations of CT scanners
- ◆ Nowadays state-of-art technology of CT system
- ◆ X-ray tube, filters and collimators
- ◆ Detectors
- ◆ Data Acquisition System

Sample question

Which of the following is NOT an advantage of MDCT?

- a) Reducing scanning time
- b) Isotropic imaging
- c) Better surface display and volume rendering
- d) Reduce the concentration of contrast medium requirement
- e) Reduce movement artifact

(B) CT image reconstruction and quality assurance

- ◆ Factors affecting radiation attenuation through patient
- ◆ Linear attenuation coefficient
- ◆ CT voxel, projections and CT numbers
- ◆ Types of image reconstruction methods
- ◆ CT image qualities and methods of measurements
- ◆ Spatial resolution
- ◆ Contrast resolution
- ◆ Image noise
- ◆ Uniformity and linearity
- ◆ CT phantoms for quality assurance
- ◆ Types of QA testing

Sample question

For fixed kVp and mAs, the value of the standard deviation in a region of interest can be reduced by:

- a) Increasing the slice thickness
- b) Decreasing the slice thickness
- c) Increasing the scan FOV
- d) Increasing the scan time
- e) Decrease the scan time

(C) Clinical application in CT imaging

- ◆ Patient preparation, contrast enhancement and scan protocols of:
 - ❖ head & neck region including orbit, face, paranasal sinuses, skull base, sella, temporal bone, oral cavity, pharynx, larynx, neck and salivary glands
 - ❖ thorax region including routine scan, high resolution scan, dissection, pulmonary embolism, pulmonary ablation, virtual endoscopy
 - ❖ abdomen & pelvis region including peritoneal cavity and vessels, liver, gall bladder, pancreas, spleen, kidneys, adrenals and gastrointestinal
 - ❖ musculoskeletal & spine region

Sample question

Prone positioning is useful in CT thorax imaging to

- a) delineate tumour at the costo-marginal region
- b) delineate pleural effusion from adhesion
- c) differentiate atelectasis from lung nodule
- d) all are true
- e) (b) and (c) only

(D) CT anatomy and pathology

- ◆ Cross-sectional anatomy of:
 - ❖ head and neck regions
 - ❖ thorax, abdomen and pelvis regions
 - ❖ musculoskeletal & spine regions
- ◆ Common CT pathologies and their CT appearances

Sample question

Which of the following statement is true about abdominal aortic aneurysm?

- a) >1.5 times of the original diameter
- b) >2 times of the original diameter
- c) >2.5 times of the original diameter
- d) >3 times of the original diameter
- e) None of the above

(E) Advance CT imaging and processing technique

- ◆ CT Cardiac imaging
- ◆ CT Perfusion studies
- ◆ CT Colonoscopy imaging
- ◆ CT Dental imaging
- ◆ CT Bone density measurement
- ◆ Common processing techniques of basic to advanced CT imaging

Sample question

QRS complex in the ECG pattern represents

- a) atrial activation
- b) atrioventricular conduction/ atrial contraction
- c) ventricular activation
- d) ventricular recovery
- e) closure of aortic valve/ end of ventricular contraction

(F) CT contrast media and application

- ◆ X-ray photon attenuation by Compton reaction
- ◆ Factors affecting tissue attenuation and lesion detectability
- ◆ Different phases of intravenous contrast administration
- ◆ Contrast dosage calculation
- ◆ Contrast medium administration and helical CT

Sample question

The use of normal saline as a chaser after the contrast medium injection is to

- a) dilute the contrast
- b) better contrast bolus utilization
- c) minimize streak artifact from right atrium
- d) (a) & (b)
- e) (b) & (c)

(G) Radiation safety and dose optimization technique in CT

- ◆ Factors affecting patient dose
- ◆ Dose measurement of CT scanning
- ◆ Radiation protective devices
- ◆ Radiation safety in CT suite
- ◆ Code of Practice of Radiation & Safety in HA Hospitals
- ◆ Dose optimization technique of CT scanning

Sample question

The three basic principles that guide radiation protection are:

- a) time, distance & kVp
- b) distance, shielding & mAs
- c) time, kVp & mAs
- d) time, distance & shielding
- e) none of the above

Suggested Reading Materials

These reading materials would provide the candidates with a sound understanding necessary to complete the Certification Examination of Computed Tomography. The suggested texts and references are provided as alternative sources of information that will assist the candidates and are not considered to be mandatory reading.

- ◆ CAMRT CT Imaging I – Theory. Rob Gamberg, 1997
- ◆ Radiographic Contrast Agents. Jovitas Skucas, An Aspen Publication, 1989
- ◆ Spiral CT. Principles, Techniques, and Clinical Applications; Elliot K, R. Brooke Jeffrey; Lippincott – Raven, 1996
- ◆ Whole Body Computed Tomography. Otto H. Wegener, Blackwell Scientific Publication 1992
- ◆ Computer Tomography for Radiographers, Brooker, M.J. USA. MTP Press Limited. 1986
- ◆ Multidetector CT, Elliot K. Fishman & R.Brooke, Jeffrey, JR, Lippincott Williams & Williams 2004
- ◆ Multidetector Computed Tomography Technology, Lorenzo Bonomo, The Royal Society of Medicine Press, 2003
- ◆ Clinical Applications of Cardiac CT, Cademartiri, Casolo, Midiri, Springer-Verlag 2007

Passing Mark and Membership of the Hong Kong College of Radiographers and Radiation Therapists

Candidates will be regarded as pass if they have attained a grade of 75% or above in the certification examination.

Candidates can be admitted as a Member of the Hong Kong College of Radiographers and Radiation Therapists (HKCRRT) (Computed Tomography) MHKCRRT(CT) if they have attained a grade of 75% or above in the certification examination **AND** achieved the requirements of CT clinical experience as set by HKCRRT. A Computed Tomography Certificate will be issued by HKCRRT for those candidates who attained a grade of 75% or above in the certification examination.

Requirements of Computed Tomography Clinical Experience

The candidates are required to complete 400 CT examinations within a 2- year period.

The 400 CT examinations shall include:

- ◆ Not less than 150 CT examinations of head & neck
- ◆ Not less than 100 CT examinations of thorax, abdomen & pelvis
- ◆ Not less than 50 CT examinations of musculoskeletal regions
- ◆ Not less than 50 CT examinations of spine
- ◆ Not less than 50 CT examinations of CT angiography

The clinical component requires the candidate's supervisor to acknowledge completion of the required clinical examinations.



The Hong Kong College of Radiographers and Radiation Therapists
香港放射師學院

HKCRRT Medical Imaging Informatics Certification

Examination

Objective

The objective of the HKCRRT Medical Imaging Informatics (MII) Certification Examination is to provide an assessment mechanism for Radiographers to attain the recognized standard in Medical Imaging Informatics to be admitted as a Member of the Hong Kong College of Radiographers and Radiation Therapists, Medical Imaging Informatics, MHKCRRT (MII).

Entry Requirements

- Being a Radiographer registered with the Hong Kong Radiographers Board; AND
- 5 years of post-registration working experience in medical imaging or radiation therapy; AND
- A recognised Bachelor degree in medical imaging, radiation therapy or equivalent

Format of Examination

150 Multiple Choice Questions covering the following areas of MII:

- | | |
|--|------|
| ● Planning and Project Management | ~5% |
| ● Communications and Training | ~5% |
| ● Operation Management | ~10% |
| ● Information Technology | ~20% |
| ● Systems Management | ~20% |
| ● Clinical and Technological Integration | ~20% |
| ● Imaging Informatics | ~20% |

Duration of Examination

3 Hours

Syllabus of Examination

(A) Planning and Project Management

- *Organisation strategic plan and policies*
- *Process for vendor selection*
- *Tendering process*
- *Project feasibility evaluation.*
- *Project management skills*
- *Development and implementation of policies and procedures*

(B) Communications and Training

- *Stakeholders in healthcare settings*
- *Knowledge in medical terminology*
- *Alerting system regarding contingency or system changes*
- *Strategies on communicating with decision-makers*
- *User feedback mechanisms*
- *Perform needs and training needs assessment*
- *Training programs implementation*
- *Training programs evaluation*

(C) Operation Management

- *Design of PACS reporting environment*
- *Integration and application of human computer interface*
- *Process to control image flow and data integrity*
- *Policy on importing and exporting studies*

(D) Information Technology

- *Archiving architecture*
- *Networking architecture*
- *Hardware and software management*
- *Data mining for operations, quality assurance, and planning purposes*
- *IT standards*
- *Replacement planning*

(E) Systems Management

- *Optimization of system capacity and throughput*
- *Planning for disaster recovery and business continuity*
- *Strategies for troubleshooting and system monitoring*
- *Data migration planning*
- *Data security and privacy*

(F) Clinical and Technological Integration

- *Capability assessment of various imaging modalities*
- *Modalities integration*
- *Quality assurance (QA) and improvement (QI) procedures*
- *Hazards in the healthcare environment*
- *Medical imaging standards (DICOM, HL7, HIPPA, MQSA, SNOMED)*
- *IHE guidelines*
- *Enterprise systems integration*

(G) Imaging Informatics

- *Image processing and enhancement*
- *Data compression*
- *3D, visualization and multi-media*
- *Speech recognition*
- *Computer-Aided Detection (CAD)*
- *Imaging facilities design*
- *Imaging vocabularies and ontologies*
- *Other new imaging technologies*

Passing Criteria

A PASS will be awarded to candidates who have attained a grade of 75% or above in the certificate examination.

(Rev. Jun 2023)

HKCRRT Mammography Certification Examination

Objective

The objective of the Certification Examination of Mammography is to provide an alternative channel for Radiographers who can attain the recognised standards in Mammography to be admitted as a Member of the Hong Kong College of Radiographers and Radiation Therapists (HKCRRT) (Mammography) MHKCRRT(Mammo) and then can quote as HKCRRT Certified Mammographer.

Entry Requirements

- ◆ Being a Radiographer registered with the Hong Kong Radiographers' Board
- ◆ 5 years of post-registration working experience in medical imaging
- ◆ A recognized Bachelor degree in medical imaging or related fields, or Professional Diploma in Diagnostic Radiography (PDDR) of the Hong Kong Polytechnic University, or equivalent

Format of examination

150 Multiple Choice Questions covering the following areas of Mammography:

- ◆ Basic Mammography knowledge and concept
- ◆ Breast anatomy
- ◆ Mammogram pattern recognition
- ◆ Basic and advanced Mammographic projections
- ◆ Protocol for breast imaging and Interventional procedures
- ◆ Trouble shooting in Mammography
- ◆ Breast Pathology
- ◆ Management of breast disease and treatment options
- ◆ Quality Management
- ◆ Nursing care
- ◆ Radiation protection

Candidates can be admitted as a Member of the Hong Kong College of Radiographers and Radiation Therapists (HKCRRT) (Mammography) MHKCRRT(Mammo) if they have attained a grade of **75%** or above in the certification examination **AND** achieved the requirements of Mammography clinical experience as set by HKCRRT.

Duration of Examination

3 hours

Examination Fee

HK\$700. 2nd attempt within 1 year as HK\$350. The first-year membership fee (\$600) will be waived if the candidate can be admitted as a member of HKCRRT.

Syllabus of Examination

| |
|---|
| A) Basic Mammography knowledge and concept |
| 1) Clinical importance of mammography |
| 2) Physics of mammography |
| 3) Anatomy and physiology of the normal breast |
| 4) Criteria for Screening Mammography and Diagnostic Mammography |
| 5) The use of other imaging modalities procedures in further investigation |
| 6) Mammographic equipment |
| 7) Mammographic image quality |
| 8) Digital mammography and image receptor characteristics. |
| |
| B) Mammogram pattern recognition |
| |
| C) Basic and advanced Mammographic projections |
| |
| D) Protocol for breast screening, diagnostic imaging and interventional procedures |
| |
| E) Trouble shooting in mammography |
| 1) Confident and proficient in all special views and modified mammographic techniques for all kinds of subjects |
| 2) Solutions to problems in operation and workflow |
| |
| F) Breast pathology |
| 1) mammographic film interpretation |
| 2) histology |
| 3) cytology |
| |
| G) Management of breast disease and treatment options |
| |
| H) Special procedures |
| 1) Advanced mammographic projections |
| 2) Interventional procedures- preparation, procedures, and after care |
| 3) Breast ultrasound |
| 4) MRI breast imaging |

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|--|
| 5) NM scintigram, sentinel node |
| I) Nursing care |
| J) Sterile procedures |
| K) Quality management |
| 1) Quality assurance programme |
| a) QA for Mammography machine |
| b)QA for all the accessories. |
| 2) Recognition of Image critique / artifacts |
| 3) Machine failure reporting system |
| 4) Quality assurance record system |
| 5) Quality control tests |
| 6) Solutions to overcome the image artifacts |
| L) Technology update |
| M) Radiation protection |
| N) Issues of research |
| O) Patient relations and education |
| P) Patient psychology and stress management |
| Q) Medico-legal aspect |
| R) Management and supervisory skills |
| S) Occupational Safety and Health (OSH) |

Suggested Reading Materials

These reading materials would provide the candidates with a sound understanding necessary to complete the Certificate Examination of Mammography. The suggested texts and references are provided as alternative sources of information that will assist the candidates and are not considered to be mandatory reading.

- ◆ The Practice of Mammography – Daniel J Dronkers, Jan H.C.L. Hendriks, Roland Holland, Gerd Rosenbusch
- ◆ Clinical Breast Imaging – Cardenosa
- ◆ Mammography for Radiologic Technologist – Wentz
- ◆ Practical Mammography – Fischer
- ◆ Breast Imaging - Peters, Voegeli, Scanlan
- ◆ Breast Imaging – Kopans
- ◆ Practical Breast Pathology – Tot/Tabar/Dean
- ◆ Teaching Atlas of Mammography – Tabar/Dean
- ◆ Breast Imaging Companion – Gilder Cardenosa

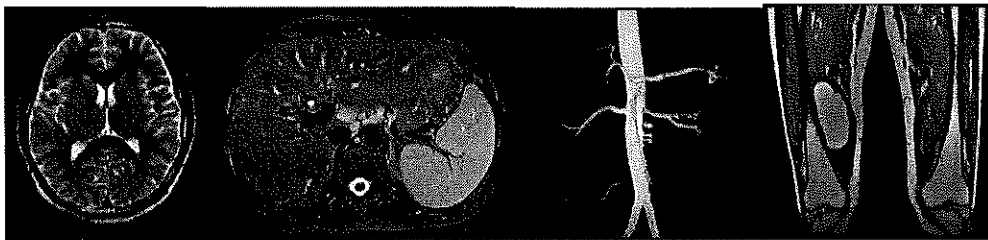
Requirements of Mammography Clinical Experience

1. The candidates are required to complete 500 sets of 4 views Single handed Mammogram in a year preceding the application for members:
For the latest 250 sets of mammogram:
 - ◆ Film rating > 75% should be in Perfect or Good Group
>97% should be in P, G, M groups. in the PGMI rating system – assessed and endorsed by mammography specialty supervisor
 2. The clinical component requires the candidates' Mammography Specialty Supervisor to acknowledge completion of the required clinical examinations.
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The Hong Kong College of Radiographers and Radiation Therapists

Certification Examination of Magnetic Resonance Imaging (MRI)



Objective

The objective of the Certification Examination of MRI is to provide an alternative channel for Radiographers who can attain the recognised standards in MR imaging to be admitted as a Member of the Hong Kong College of Radiographers and Radiation Therapists (HKCRRT) (Magnetic Resonance Imaging) MHKCRRT(MRI).

Format of Certification Examination

150 Multiple Choice Questions covering basic principles and clinical applications of MRI such as:

- ◆ MRI Physics (55%)
- ◆ MRI Clinical Applications (10%)
- ◆ MRI Safety (10%)
- ◆ MRI Contrast Medium (10%)
- ◆ MRI Pathology (10%)
- ◆ MRI Anatomy (5%)

{Please refer to the section of syllabus of examination for details.}

Duration of Examination

3 hours

Syllabus of Examination

(A) MRI Physics

- ◆ Nuclear Physics
- ◆ Relaxation mechanism
- ◆ Spatial encoding of MRI signals
- ◆ K-space sampling techniques
- ◆ Fourier transformation
- ◆ Image contrast mechanisms
- ◆ Image quality optimization
- ◆ Image compensation techniques – flow compensation, spatial saturation, spectral saturation, respiratory and cardiac gating / triggering, navigator echo, magnetization transfer pulse etc.
- ◆ MRI pulse sequence structure, design and imaging characteristics
- ◆ Concept of pulse sequence diagram
- ◆ Implications of changing pulse sequence parameters such as TR, TE, flip angle etc.
- ◆ Spin echo and fast spin echo imaging
- ◆ Gradient echo imaging
- ◆ Inversion recovery sequences
- ◆ Echo Planar Imaging (EPI)
- ◆ Diffusion-weighted imaging (DWI)
- ◆ Diffusion tensor imaging (DTI)
- ◆ Perfusion imaging
- ◆ Single- and multi-voxel MR spectroscopy
- ◆ Flow dependent MR angiography / venography
- ◆ Contrast-enhanced MR angiography / venography
- ◆ Time-resolved imaging of contrast kinetics
- ◆ Parallel imaging techniques
- ◆ Design of various magnet systems used in MRI
- ◆ Spatial encoding gradient coils
- ◆ Radiofrequency system including phase array coils
- ◆ Basic quality assurance of MRI system
- ◆ Recognition of imaging artifacts induced by the system hardware, pulse sequences, poor operator choices, physiological and patient motion etc.
- ◆ Basic principles of MRI artifacts and corresponding compensation techniques
- ◆ Motion artifacts
- ◆ Aliasing or wrap-around artifacts
- ◆ Magnetic susceptibility artifacts
- ◆ Gibbs or truncation artifacts
- ◆ Chemical shift artifacts
- ◆ RF leakage or Zipper artifacts

- ◆ Moire fringes
- ◆ Magic angle artifacts
- ◆ Other imaging artifacts due to hardware failure

(B) MRI Clinical Applications

- ◆ Clinical applications of various MRI pulse sequences and imaging applications in clinical settings for diagnosis of different disease entities

(C) MRI Safety

- ◆ Effect of static magnetic field
- ◆ Effect of time-varying gradient magnetic field
- ◆ Effect of radiofrequency field
- ◆ Magnetic and radiofrequency shielding
- ◆ Cryogen-related issues
- ◆ Safety concerns of MRI site planning
- ◆ Patient screening
- ◆ Basic emergency procedures

(D) MRI Contrast Media

- ◆ Extra-cellular contrast agents
- ◆ Tissue-specific contrast agents
- ◆ Intravascular or blood pool contrast agents
- ◆ Positive & negative contrast agents
- ◆ Safety of MRI contrast agents

(E) MRI Pathology

- ◆ Common MRI pathologies and their MRI appearances

(F) MRI Anatomy

- ◆ Neuro-anatomy including grey/white matter differentiation, ventricular system and vascular structures
- ◆ Spinal anatomy
- ◆ Musculoskeletal anatomy
- ◆ Body anatomy including heart, thorax, abdomen and pelvis

The Hong Kong College of Radiographers and Radiation Therapists (HKCRRT)
Medical Dosimetry Certification Examination

Objective:

To provide an examination for practicing Radiation Therapist to attain a recognized standard in medical dosimetry to be admitted as a member of the Hong Kong College of Radiographers and Radiation Therapists, Medical Dosimetry.

Entry Requirements:

1. Being a Radiation Therapist registered with the HK Radiographer's Board.
2. With a minimum of 2 years of post-registration working experience in medical dosimetry.
3. A recognized Bachelor degree in radiotherapy or related fields.

Format of online Examination:

150 Multiple Choice Questions covering the following areas of Medical Dosimetry:

| | |
|----------------------------|-------|
| (A) Radiation Physics | (15%) |
| (B) Dose calculation | (20%) |
| (C) Treatment Planning | (30%) |
| (D) Localisation | (15%) |
| (E) Brachytherapy | (5%) |
| (F) Radiation protection | (5%) |
| (G) Quality Assurance | (5%) |
| (H) Information technology | (5%) |

(Please refer to the section of syllabus of examination for details)

Candidates can be admitted as a member of the HKCRRT (Medical Dosimetry) if they have passed the examination AND achieved the requirements of clinical training and experience as set by HKCRRT. A Certificate will be issued by HKCRRT for those candidates who passed the certification examination.

Duration of Examination:

3 hours

Schedule of Examination:

Please refer to the poster in HKCRRT official website for details.

Examination fee:

HK\$700

The first-year membership fee (HK\$700) will be waived if the candidate can be admitted as a member of HKCRRT.

Syllabus of Examination:

(A) Radiation Physics

- ▲ Radioactivity
- ▲ X-ray production and characteristics of radiations
- ▲ Radiation measurement and related equipment

(B) Dose calculation

- ▲ External beam of photon and electron calculations
- ▲ Beam modification devices effect
- ▲ Tissue inhomogeneities

(C) Treatment Planning

- ▲ Dose distribution of photon and electron
- ▲ Clinical Oncology and treatment schemes
- ▲ Radiobiology and calculations
- ▲ Interpretation of Dose Volume Histogram
- ▲ IMRT

(D) Localisation

- ▲ Patient data acquisition
- ▲ Patient positioning and immobilization
- ▲ Special set up devices
- ▲ Treatment simulations
- ▲ Medical imaging for oncology
- ▲ Image registration

(E) Brachytherapy

- ▲ Radioactive sources characteristics
- ▲ Dose distributions
- ▲ Application of radioactive sources

(F) Radiation protection

- ▲ Radiation monitoring for personnel and patients
- ▲ Principles of radiation protection

(G) Quality Assurance

- ▲ Equipment safety and accuracy
- ▲ Plan and treatment accuracy

(H) Information technology

- ▲ Data importing and exporting

- ▲ Computer system management
- ▲ Planning computer algorithms

Suggested Reading Materials:

The Candidates will find the following reading materials helpful for the Medical Dosimetry Certification Examination. The materials should not be considered mandatory and **other sources of related information** are not exclusive.

1. The Physics of Radiation Therapy. **Faiz M. Khan**. Lippincott Williams & Wilkins 5th edition or above
2. Treatment Planning in Radiation Oncology. **Faiz M. Khan. Bruce J. Gerbi**Lippincott Williams & Wilkins
3. Practical Radiotherapy Planning. **Ann Barrett**. Arnold
4. Radiation Therapy Physics. **William R. Hendee. Geoffrey S. Ibbott**. Wiley
5. Radiation Therapy Planning. **Bentel G.C** McGraw Hill. 2nd edition or above