Hong Kong Institution of Physicists in Medicine
香港醫學物理學院

Examinations for Professional Certification of Medical Physicists

Guide to Candidates & Syllabus

CHAPTER 1

CERTIFICATION EXAMINATION SYSTEM

1 The Certification Scheme

The Hong Kong Institution of Physicists in Medicine (HKIPM) operates a professional certification scheme which is adopted from that recommended by International Medical Physics Certification Board (IMPCB). Details of the certification scheme are described in the HKIPM document "**A Scheme for Professional Certification of Medical Physicists**" which is downloadable from HKIPM website. The HKIPM can offer certification in the following specialties:

(a) Radiation Oncology Physics
(b) Medical Imaging Physics

2 Examination Format

The certification examination consists of three parts as detailed below.

(a) Part I is designed to test the knowledge of the candidate in fundamental aspects of medical physics (General Medical Physics).
(b) Part II is designed to determine the knowledge and competence of the candidate in a specialty area of medical physics (such as Radiation Oncology Physics or Medical Imaging Physics).
(c) Part III is designed to determine the candidate's knowledge, competence and fitness to practice clinical medical physics in a designated sub-specialty (Radiation Oncology Physics or Medical Imaging Physics).

3 Part I Certification Examination

The Part I certification examination shall be a written MCQ paper. The paper contains 110 MCQ covering general physics, radiation oncology physics, medical imaging physics, therapeutic and imaging radiological equipment and clinical aspect of health physics. The MCQ questions are prepared from a bank of questions which are established mainly based on the syllabus of the Part I Certification Examination. The questions will be reviewed by an external examiner to be appointed by HKIPM. The duration of the Part I examination is 3.0 hours.
The MCQ questions shall be distributed in four modules:

General physics module	20 questions
Radiotherapy physics module*	30 questions
Imaging physics module*	30 questions
Radiation safety and protection module*	30 questions

(*No more than 5 questions on special topics are included in each of these modules.)

For each MCQ, the candidate will be awarded 1 mark for giving a correct answer to the question and no mark will be given for an incorrect answer or not giving an answer to the question or giving multiple answers.

Candidate has to pass each module	
Score for passing a module	60% of the score for the module
Score for passing the paper:	60%
Score for passing with distinction	90%

4 Part II Certification Examination

Part II Certification Examination is a written examination which will mainly be based on, but not limited to, the relevant part of the syllabus of Part II Certification Examination as defined for the respective specialty of medical physics. The examination questions will be reviewed by an external examiner to be appointed by HKIPM.

The Part II examination shall last 3.0 hours. The questions shall mainly be focused on the specialty/sub-specialty selected by the candidate.

Score for passing a Part II paper is 60% and passing with distinction is 90%.

5 Part III Certification Examination

This will be a viva examination. The examination shall be conducted by four examiners to be appointed by HKIPM. One of examiners should normally be an external examiner. At least three of the examiners shall be specialists in the same or closely related specialty/subspecialty of the examination.

Part III examination shall last approximately 1.5 hours. The questions shall mainly be focused on the medical physics specialty selected by the candidate.

6 Examination Results

Results of the examination will be sent to the candidates individually. Any query or appeal to the examination should be addressed to the Secretary of Examination Committee within 2 weeks from the result announcement. The candidate should state clearly the query or appeal, the reasons for raising it and provide relevant information about the examination including, his/her name, name of the examination, time and venue of the examination etc.

CHAPTER 2

EXAMINATION FORMAT

Part I Certification Examination

Multiple-choice Paper

1 The examination paper will consist of 110 MCQs, which will be based on the syllabus for the Certification Examination. The duration of the examination is 3.0 hours. The paper will be presented in the form of a combined MCQ paper/answer book. The candidates are not allowed to copy the questions from the paper or take the paper away from the examination room.

2 Each MCQ comprises of a question or statement and five answers, which are labeled (A) to (E). Candidates are asked to write down on the paper at the space provided immediately below the question the alphabet which represents the best answer to the question or the best item to complete the statement. Candidates should answer all the MCQs.

3 Candidates should use black ink and write neatly to answer the questions. If the examiners cannot read the candidate's writing they will be unable to give full credit for the candidate's knowledge.

Part II Certification Examination

Written Paper

1 The examination paper will consist of MCQs and short questions, which will be based on the syllabus for Part II Certification Examination given in Appendix B. The duration of the examination is 3.0 hours. The candidates are not allowed to copy the questions from the paper or take the paper away from the examination room.

2 The format of the MCQ questions shall be similar to that of the Part I Certification Examination.

3 Candidates shall attempt all MCQ and short questions.

4 Candidates should use black ink and write neatly to answer the questions. If the examiners cannot read the candidate's writing they will be unable to give full credit for the candidate's knowledge.

Part III Certification Examination

1 The examination shall be in the form of an oral examination and shall be conducted by a panel of 4 examiners, one of whom is usually an external examiner. The total examination time for each candidate shall be approximately 1 hour and 30 minutes.

2 The examination will be focused on the practical aspect of medical physics work and shall mainly be based on, but not limited to, the relevant part of the syllabus of Part III Certification Examination given in Appendix C. The candidate's training logbook also serves as a reference for the examiners.

3 For each specialty, the examination will be focused mainly on 5 major topics as follows:

(a) Radiation Oncology Physics:
    (i) Radiation Protection
    (ii) Radiation Dosimetry
    (iii) External Beam Treatment Planning
    (iv) Brachytherapy
    (v) Quality Assurance

(b) Medical Imaging Physics:
    (i) Radiation Protection
    (ii) Digital Imaging
    (iii) CT
    (iv) MRI and Ultrasound
    (v) Nuclear Medicine
    (The subject on QA is included in each topic)

4 The performance of a candidate in the examination shall be assessed and scored by every examiner. The score from each examiner shall be added to form the total topic score and the sum of all the individual topic score shall form the total final score of the candidate. In order to pass the examination, a candidate has to achieve (a) a score of not less than 60% in the total final score, and (b) a score of not less than 40% in any individual topic.

5 It is important that each candidate shall bring along his/her training logbook and present it to the Chief Examiner immediately after admitted to the examination room.

6 English shall be used during the examination.

CHAPTER 3

APPLICATION PROCEDURES AND REQUIREMENTS

The Examination

The Certification Examination is to qualify the successful candidates for the next phase of certification process. Qualified candidates may apply for the following examinations:

(i) Part I Certification Examination
(ii) Part II Certification Examination in Radiation Oncology Physics
(iii) Part II Certification Examination in Medical Imaging Physics
(iv) Part III Certification Examination in Radiation Oncology Physics
(v) Part III Certification Examination in Medical Imaging Physics

Requirements

1 Candidates applying for sitting in any parts of the Certification Examination shall be a member of HKIPM.
2 Eligibility for Part I Certification Examination
   a. Candidates shall have an advanced degree (master's degree or doctoral degree) in physics, medical physics or an equivalent degree in an appropriate physical or engineering science discipline, and
   b. Professional training is not required.
3 Eligibility for Part II Certification Examination
   a. Candidates applying for sitting in Part II Certification Examination shall have passed the Part I Certification Examination, and
   b. Candidates shall be practicing medical physicists, and
   c. Candidates shall have an advanced degree (master's degree or doctoral degree) in physics, medical physics or an equivalent degree in an appropriate physical or engineering science discipline, and
   d. Candidates shall have at least two years recognized full-time equivalent training as a medical physicist in a medical institution preceding the date of application for examination. The training should be carried out under the guidance of a certified medical physicist specializing in the same sub-field or under the guidance of a qualified individual with a level of professional experience and expertise equivalent to that of a certified medical physicist.
4 Eligibility for Part III Certification Examination
   a. Candidates applying for sitting in Part III Certification Examination shall have passed the Part II Certification Examination, and
   b. Candidates shall be practicing medical physicists, and
   c. Candidates shall have at least two years recognized full-time equivalent working experience as a medical physicist in a medical institution preceding the date of examination.

Supporters

1 A supporter is not required for application for Part I Certification Examination.
2 Application for Part II Certification Examination shall be supported by a Supporter who can verify the years of medical physics service or training and has access to the service or training logbook of the applicant. The Supporter can be the supervisor or honorary supervisor of the applicant. The Supporter should be a certified medical physicist (CMP) who has been granted professional

certification by HKIPM or a professional medical physics certification body recognized by HKIPM.

3 Application for Part III Certification Examination shall be supported by a minimum of two supporters with at least one of them a CMP who has been granted professional certification by HKIPM or a professional medical physics certification body recognized by HKIPM. If one of the supporters is a CMP, then the other supporter can be a CMP, a radiation oncologist (if applying for Radiation Oncology Physics exam) or a radiologist (if applying for Medical Imaging Physics exam). If there is no in-house CMP, then one of the supporters shall be an external honorary supervisor who is a CMP. At least one of the supporters should be the supervisor of the applicant who shall be able to verify the training activities as listed in the training log book of the applicant.

Examination Fees

Part I: $2000
Part II: $2000
Part III: $4000

Application Procedures

1 Application forms can be downloaded from HKIPM website.
2 A crossed cheque made payable to 'Hong Kong Institution of Physicists in Medicine' for the examination fee shall be submitted together with the application form.
3 For application of Part I Certification Examination, documentary proof of academic qualifications shall be submitted with the application form.
4 For application of Part II and Part III Certification Examination, documentary proof for the duration of service as a physicist in a medical institution as claimed by the applicant shall be submitted with the application form.
5 Completed application form with documentary proof and a cheque for the examination fee shall be submitted to the Secretary of HKIPM:

Ms. Ruby Ho,
c/o Medical Physics & Research Department,
8/F, Li Shu Fan Block,
Hong Kong Sanatorium & Hospital,
Happy Valley,
Hong Kong.

6 Application should reach the Secretary of HKIPM on or before the application deadline. Late applications will not be accepted. Postmark date on the envelope will be regarded as the application date.
7 The Certification Board of HKIPM shall have absolute power and discretion in deciding upon any application for taking part in the Certification Examination and its decision shall be final, and it shall not be bound to give any reason for its decision.

CHAPTER 4

INSTRUCTIONS TO CANDIDATES

Instructions to Candidates taking Part I & Part II Certification Examination

Personal Identification
Each candidate shall bring an official identification document with photograph such as HK ID card or passport.

Arrival to Examination Centre
The candidate shall report to the HKIPM examination official at the examination centre at least 15 minutes before the examination time as assigned for him/her. The official will check the candidate's ID card or passport for identification purpose. A candidate who arrives more than 15 minutes later than the designated examination time may not be admitted to take the examination.

Personal Belongings
Candidates must place all personal belongings to the back/side of the examination room during the examination. Small handbags may be placed under the candidate's chair or desk and do not obstruct the aisle. Any pagers or mobile telephones brought to the examination room by a candidate must be turned off during the examination session.

Bad Weather Arrangements
When a no. 8 or higher typhoon signal is hoisted or a black rainstorm warning is in effect:

Before the examination
The examination will be postponed until further notice.

During the examination
The examination will continue unless the location is unsafe.

Examination Instructions
The candidates shall carefully read and comply with the instructions on the examination paper. They shall also listen carefully to any announcements as may be made by the invigilator before, during and at the end of the examination.

Electronic Calculator
Candidates are allowed to use electronic calculator of the type approved by the Hong Kong Examination Authority. Candidates shall be responsible to bring their own electronic calculator to the examination. No personal digital assistant devices are allowed.

Examination Papers
1 Candidates are allowed with 3.0 hours (same for Part I and Part II) to answer all the questions on the paper.
2 Candidates will be provided with a combined question/answer book.
3 Write the "Candidate Number" in the space provided on the front page of the

question/answer book.

4 Observe any guidance as may be given on the question/answer book.
5 For each question, write the answer that represents the best answer to the question.
6 Write the answer to the MCQ question in (A), (B), (C), (D), or (E) only in the space provided for each question.
7 No extra paper will be available for MCQ questions.
8 Candidates should answer all questions.
9 Write the answers clearly in black ink. If the examiners cannot read the candidate's writing they will not be able to give full credit for the candidate's knowledge.
10 Amend mistakes carefully.
11 Hand in the question/answer book to the invigilators at the end of the examination.
12 Candidates should remain seated at the end of the examination until the invigilators have collected all the question/answer books and announced that candidates can leave the examination room.

Instructions to Candidates taking Part III Certification Examination

Personal Identification
Each candidate shall bring an official identification document with photograph such as HK ID card or passport.

Arrival to Examination Centre
The candidate shall report to the HKIPM examination official at the examination centre at least 15 minutes before the examination time as assigned for him/her. The official will check the candidate's ID card or passport for identification purpose. A candidate who arrives more than 15 minutes later than the designated examination time may not be admitted to take the examination. Any late candidates shall be asked to record the reason for their late arrival.

Oral Examination

1 During the examination, it is the responsibility of the candidate to answer each question fully and precisely within a reasonable time.
2 English shall be used during the oral examination.

Bad Weather Arrangements
When a no. 8 or higher typhoon signal is hoisted or a black rainstorm warning is in effect:

Before the examination
The examination will be postponed until further notice.

During the examination
The examination will continue unless the location is unsafe.

APPENDIX A

SYLLABUS FOR PART I EXAMINATION

(All modules to be taken by all candidates)

Basic Physics

1. Structure of matter
2. Classical and relativistic mechanics
3. Electricity and magnetism
4. Atomic and nuclear physics

Basic Radiation Physics

1. Atomic and nuclear physics
1.1. Radioactivity
1.2. Radioactive decay modes
1.3. Half life, mean life and biological half life
1.4. Nuclear reactions
1.5. Radionuclides production by activation

2. Production of X-rays
2.1. Principles of X-ray production
2.2. Bremsstrahlung spectra and characteristic X-rays
2.3. Quality of X-rays
2.4. Measurement of half value layer (HVL)

3. Interaction of ionizing radiation with matter
3.1. Excitation and ionization
3.2. Interaction cross-sections and interaction coefficients
3.3. Rayleigh scattering, photoelectric effect, Compton scattering and pair production
3.4. Relative importance of interaction types
3.5. Multiple scattering of electrons
3.6. Stopping power and linear energy transfer (LET)
3.7. Bragg peak of proton and other heavy charged particles
3.8. Neutrons

4. Radiation detectors and instrumentation
4.1. Principles of radiation detection
4.2. Counting statistics
4.3. Basic electronics design of detector circuits
4.4. Principles and modes of operation of common practical dosimeters (e.g. Geiger counter, proportional counter, scintillation counter, TLD, diode detector etc.)
4.5. Introduction to multi-channel analysers

5. Measurement of ionizing radiation
5.1. Exposure, air kerma and dose

5.2. Bragg-Gray principle
5.3. Ion chamber theory, designs and operation
5.4. Absorbed dose standards
5.5. Introduction to dosimetry protocols (e.g. IAEA 398, TG 51, MIRD etc.)
5.6. Patient dose measurements in radiation therapy
5.7. Dose area product and patient dose reduction in diagnostic radiology

Radiotherapy Physics and Systems

1. Principles and characteristics of major radiotherapy equipment
1.1. Superficial X-ray unit, Orthovoltage X-ray unit and Co-60 unit
1.2. Linear accelerators
1.3. Conventional and CT-simulators
1.4. Afterloading units

2. Superficial X-ray and megavoltage photon and electron beams characteristics
2.1. Buildup, skin dose, beam flatness and penumbra
2.2. Equivalent square field
2.3. Wedge field and asymmetric field of photon beams
2.4. Field-size dependence of percentage depth dose, output factors etc.
2.5. Beam energy dependence of percentage depth dose, output factors etc.
2.6. SSD dependence and inverse square law correction
2.7. Effect of inhomogeneities and obliquity
2.8. Electron contamination in photon beams
2.9. Neutron production and activation in high-energy photon beams
2.10. Derivation of electron beam energies from depth dose measurement
2.11. Photon contamination in electron beams

3. Principles of radiotherapy
3.1. Role of radiotherapy in cancer treatment
3.2. Dose responses of healthy and tumorous tissues
3.3. Requirements for dose uniformity and conformity
3.4. Sparing of critical structures and organs
3.5. Patient positioning and immobilisation techniques
3.6. Radiobiological effects of treatment fractionations

4. Principles of external beam treatment planning and dose calculations
4.1. ICRU definitions of CTV, GTV, PTV etc.
4.2. Use of CT for contouring
4.3. Choice of beam arrangements and beam weightings
4.4. Use of beam modifiers (shield, wedge, compensator and bolus)
4.5. Field shaping (MLC, lead and alloy blocks)
4.6. Use of dynamic wedge, virtual wedge, auto wedge etc.
4.7. SSD, extended SSD, isocentric and rotation techniques
4.8. Dose prescription, calculation and normalisation
4.9. Examples in 3-D conformal treatment

5. Radiation therapy simulation, delivery and verification
5.1. Conventional X-ray simulation
5.2. CT simulation
5.3. Treatment setup

5.4. Patient motion
5.5. Portal imaging

6. Quality assurance of radiotherapy equipment
6.1. Rationale of quality assurance
6.2. Core specifications of major radiotherapy equipment
6.3. Measurement of performance tolerances (electrical, mechanical and radiation)
6.4. Record keeping and report writing

7. Radiation protection in radiotherapy
7.1. General concepts of radiation protection
7.2. Designation of areas and classification of workers
7.3. Dose limits and risk estimation of radiation exposure
7.4. Personnel monitoring and area survey
7.5. Use of practical dosimeters in radiation protection
7.6. Protective design in radiotherapy suites
7.7. Introduction to Local Rules and Code of Practice
7.8. Overview of the Radiation Ordinance of Hong Kong

Medical Imaging Physics and Systems

1. X-ray systems
1.1 X-ray tube design
1.2 X-ray spectrum
1.3 X-ray tube rating
1.4 Power supply generator
1.5 Control circuits
1.6 Factors influencing X-ray output
1.7 Quality assurance

2. Film-screen radiography and film processing
2.1 Radiographic principles
2.2 Film screen combination
2.3 Film processing and management
2.4 Image quality - contrast, resolution and MTF
2.5 Factors influencing image quality
2.6 Radiography image artifacts
2.7 Quality assurance

3. Fluoroscopic imaging systems
3.1 Basic principles
3.2 Fluoroscopy systems design
3.3 Automatic brightness control
3.4 Factors influencing image quality
3.5 Radiation dose and modes of operation
3.6 Artifacts
3.7 Hard copy recording
3.8 Quality assurance

4. Basic principles and clinical applications of other imaging modalities
4.1 Computed tomography
4.2 Magnetic resonance imaging
4.3 Ultrasound

4.4 Nuclear medicine

Principle of Signal Processing and Imaging Processing for Medical Physics

1. Signal processing

1.1 Nature and origin of biomedical signals
1.2 Linear time-invariant theory
1.3 Signal sampling and quantification
1.4 Frequency domain analysis of signals
1.5 Filtering techniques
1.6 Signal processing software

2. Image processing

2.1 Digital image formation
2.2 Intensity transformation and geometric transformation
2.3 Visualization
2.4 Image enhancement in spatial domain and in frequency domain
2.5 Image compression and data management

Radiation Safety and Protection

1. Radiations effects on human

1.1 Natural background radiation
1.2 Hazards of low levels of radiation
1.3 Types of radiation exposure and hazards in hospital environment
1.4 Biological and health effects
1.5 Radiobiological effectiveness (RBE)
1.6 Radiation weighting factor

2. Protection quantity and units

2.1 Equivalent dose
2.2 Effective dose
2.3 Risk factors and collective doses
2.4 Radiation risk estimate

3. Radiation protection principles

3.1 ICRP recommendations
3.2 Dose limit
3.3 Time and distance
3.4 Use of shielding in radiation protection
3.5 Control and containment of radioactive substances
3.6 ALARA

4. Radiation survey and measurement

4.1 Common radiation detection and monitoring instruments
4.2 Instrument calibrations
4.3 Radiation survey and monitoring
4.4 Personnel dose monitoring

5. Practical radiation protection in hospital environment

5.1 Laboratory procedures of radionuclide therapy and imaging
5.2 Wipe test
5.3 Decontamination

5.4 Radioactive source transport
5.5 Safe custody and inventory of radioactive sources
5.6 Safe custody of sealed and unsealed radioactive sources
5.7 Storage and disposal of radioactive wastes
5.8 Practical methods of radiation protection in hospital
5.9 Classification of radiation working areas and radiation workers

6. Administrative measures and legislative control

6.1 Administration and organization for radiation protection in current HA Code of Practice on radiation safety & protection in HA hospitals
6.2 Local radiological protection rules
6.3 Legislative control- Hong Kong Radiation Ordinance

Special Topics

1 Professional ethics and conducts

2 Medical statistics

2.1 Medical Statistics
2.2 Presentation of medical data
2.3 Sampling method
2.4 Regression analysis
2.5 Non-parametric method
2.6 Cancer survival analysis
2.7 Clinical trial
2.8 Epidemiology

3 Human anatomy

3.1 Introduction to the human body and anatomical terminology
3.2 Introduction to human body systems
3.3 Basic biophysics and biochemistry
3.4 Basic physiology of major organs component
3.5 Basic human health, etiology of disease and trauma.
3.6 Basic pathology in medical images

4 Radiobiology

4.1 General principles of radiobiology
4.2 Assays for cell survival and radiation damage
4.3 Cell culture and mouse models in radiobiology studies
4.4 Cell survival curves, radiation damage and repair
4.5 Biological dosimetry techniques
4.6 Oxygen effects, hypoxia and biological modifiers
4.7 Physical factors affecting cell survival, fractionation and 4R
4.8 Factors affecting therapeutic ratio and hyperthermia
4.9 Tumour and normal cell radiobiology

APPENDIX B

SYLLABUS FOR PART II EXAMINATION

Radiation Safety & Protection (To be taken by all candidates)

1. Shielding techniques for radiological facilities

1.1 What is WUT?
1.2 Treatment room design (primary, scatter and leakage radiation)
1.3 Neutron production from linear accelerator emanating high-energy photons
1.4 Structural shielding design for teletherapy and brachytherapy
1.5 Structural shielding design for diagnostic imaging facilities
1.6 Special considerations for sealed radioactive sources
1.7 Special considerations for unsealed radioactive sources

2. Planning of radiological equipment for radiation protection

2.1 Site planning
2.2 Machine commissioning
2.3 Accident procedures and emergency planning
2.4 Local rules
2.5 Licensing requirement in Hong Kong

3. Risk of radiological procedures

3.1 Patient protection and patient doses
3.2 Effective doses and risks in radiology
3.3 Risks from radiological examinations
3.4 Risk from ingested or injected activity
3.5 Special high-risk situations – irradiation of children or in-utero
3.6 Risk associated with an abdominal examination for pregnant patient

Advanced Radiotherapy Physics and Systems (To be taken by all candidates sitting for the Part II Certification Examination in Radiation Oncology Physics)

1. High-energy photon and electron beams dosimetry and calibrations

1.1. Overview of current high-energy X-ray and electron dosimetry protocols
1.2. Dose calculation formalisms
1.3. Machine output calibrations
1.4. IAEA TLD dose audit for high-energy X-rays

2. Superficial X-ray dosimetry and calibration

2.1. Overview of current low-energy X-ray dosimetry protocol
2.2. Dose calculation formalism
2.3. Machine output calibration

3. Brachytherapy dosimetry and source calibration

3.1. TG-43 definitions of source strength, anisotropy, radial dose distribution etc.
3.2. Dose calculations using TG-43 formalism
3.3. Calibration of high dose rate (HDR) sources
3.4. Calibration of intravascular brachytherapy sources
3.5. Calibration of manual implant sources

3.6. Calibration of unsealed radioisotope sources
3.7. Use of radionuclides dose calibrator

4. Principles of external beam treatment planning

4.1. Choice of treatment modality and beam energy
4.2. Choice of localization and immobilization techniques
4.3. Use of CT images and MR fusion in contouring
4.4. Beam's eye view and digital reconstructed radiographs (DRR)
4.5. Beam alignment (including non-coplanar) and shaping
4.6. Beam weightings and use of beam modifiers
4.7. Field matching and splitting
4.8. Plan evaluation with isodose curves and dose volume histograms (DVH)
4.9. Fractionation schemes and radiobiological modeling

5. Computerised treatment planning

5.1. Dose computation algorithms
5.2. 3-D conformal planning
5.3. Stereotactic planning
5.4. Intensity modulated radiation therapy (IMRT) planning
5.5. Afterloading planning

6. Methodology of dose calculations in treatment planning

6.1. Percentage depth dose and isodose curves
6.2. Output factors (collimator scatter factor, phantom scatter factor and peak scatter factor)
6.3. Wedge factor, tray factor, inverse square factor and Mayneord factor
6.4. Tissue air ratio (TAR), tissue maximum ratio (TMR) and tissue phantom ratio (TPR)
6.5. Backscatter factor, Scatter air ratio and scatter maximum ratio
6.6. Patient homogeneities and contour corrections
6.7. MU calculations

7. External beam radiotherapy techniques

7.1. Conventional SSD, extended SSD, isocentric and arc techniques
7.2. Parallel opposing and box techniques
7.3. Use of asymmetric field and field-in-field
7.4. Coplanar and non-coplanar techniques
7.5. 3-D conformal, stereotactic and IMRT techniques
7.6. Mixed modality and mixed energy techniques
7.7. Very large field techniques (total body irradiation (TBI) and total skin irradiation)
7.8. Use of treatment aid and accessories

8. Brachytherapy techniques

8.1. Dosimetry of manual implants (Manchester and Paris systems)
8.2. Source localization and dose calculation
8.3. LDR, HDR and intravascular treatments
8.4. Radioisotopes treatment
8.5. Manual implants

9. Physical aspects of quality assurance in radiotherapy

9.1. Acceptance testing, commissioning and QA of radiotherapy equipment
9.2. Measurement of machine performance tolerances

9.3. Rectification of performance deviations
9.4. Scheduling of QA procedures

10. Radiation safety and protection in radiotherapy
10.1. Shielding calculations and room design
10.2. Licensing procedures
10.3. Review of Local Rules and Code of Practice and radiation contingency plans
10.4. Roles of radiation protection supervisor (RPS) and adviser (RPA)
10.5. Incidence investigation and reporting

Medical Imaging Physics and Systems (To be taken by all candidates sitting for the Part II Certification Examination in Medical Imaging Physics)

1. Digital imaging
1.1. Image receptors and conversion
1.2. Data sampling and aliasing
1.3. Image matrix, spatial resolution and volume averaging
1.4. Image processing
1.5. Display and analysis
1.6. Picture archiving and communication systems
1.7. Digital radiography system
1.8. Computed radiography
1.9. Acceptance testing, commissioning and quality assurance

2. Computed tomography
2.1. Detectors and detector arrays
2.2. Data acquisition and image reconstruction
2.3. Image quality and artifacts
2.4. Radiation dose
2.5. Acceptance testing, commissioning and quality assurance

3. Magnetic resonance imaging
3.1. Machine hardware and imaging coils
3.2. MR signals and spatial encoding
3.3. Image reconstruction
3.4. Common pulse sequences
3.5. MR Spectroscopy
3.6. Image quality and artifacts
3.7. Safety considerations
3.8. Acceptance testing, commissioning and quality assurance

4. Ultrasound
4.1. Transducers
4.2. Data acquisition and mode of operations
4.3. Doppler
4.4. Image quality and artifacts
4.5. Acceptance testing, commissioning and quality assurance
4.6. Bio-effects and safety

5. Nuclear medicine
5.1. Principle of radiochemistry, radionuclide imaging and radiopharmacy
5.2. Gamma camera and laboratory instruments design
5.3. Data acquisition and display

5.4. Emission computed tomography
5.5 Positron Emission Tomography
5.6. Radiation measurement and counting statistics
5.7. Image quality and artifacts
5.8. Radiation dose
5.9. Acceptance testing, commissioning and quality assurance

6. Principles of special imaging systems
6.1. DSA cardiovascular imaging system
6.2. DSA angiography system
6.3. Bone densitometry
6.4. Mammography

7. Radiation safety and protection in diagnostic radiology
7.1. Radiation hazards in diagnostic radiology
7.2. Dosimetry measurement and assessment
7.4. Protection of patient and staff
7.3. Dose reduction techniques
7.4. Room design

APPENDIX C

SYLLABUS FOR PART III EXAMINATION

Part III examination shall be a viva examination. The examination will be focused on the practical aspect of medical physics work and the area of competence shall cover the syllabus for the Part I and Part II Certification Examinations as given in Appendices A and B.