IPEM
Institute of Physics and Engineering in Medicine

Accreditation of Undergraduate Programmes

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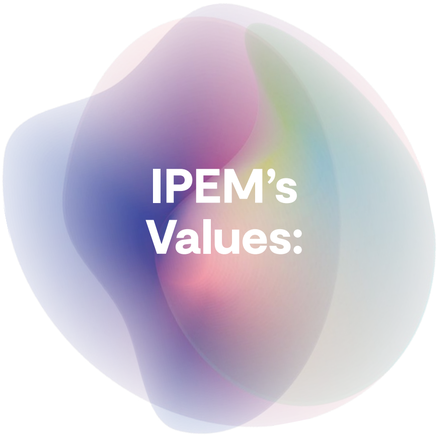
1 – IPEM Undergraduate Accreditation

IPEM Accreditation of degree programmes gives higher education institutions (HEIs) and prospective students confidence that courses meet the expected quality and learning outcomes required for a career in medical physics/clinical engineering. Accreditation supports clinical technologists and practitioners in their practice through the provision and assessment of education and training. Accreditation supports IPEM's dedication to developing the next generation of medical physicists and clinical engineers. This accreditation scheme aims to ensure that graduates of accredited programmes are equipped with the knowledge and skills for the medical physics or clinical engineering workplace, be that in industry, healthcare, or academic environments. Accreditation gives confidence that the course meets strict suitability and quality criteria for providing education in this field[1].

Contents

Improving health through Physics and Engineering in Medicine.

Developing the professional, improving healthcare, transforming lives together.



Trusted
The leading voice in improving health through physics and engineering.

Inclusive
Enabling a diverse and inclusive professional community.

Progressive
Delivering innovative practice development for the public good.

A few benefits to having an accredited degree programme include:

- Accreditation is recognised as a high-quality seal of approval throughout industry and academia internationally.
- Accredited programmes can display the Certificate of Accreditation and may use the IPEM accredited logo on promotional material and documentation.

IPEM | Undergraduate Level Programme Accredited

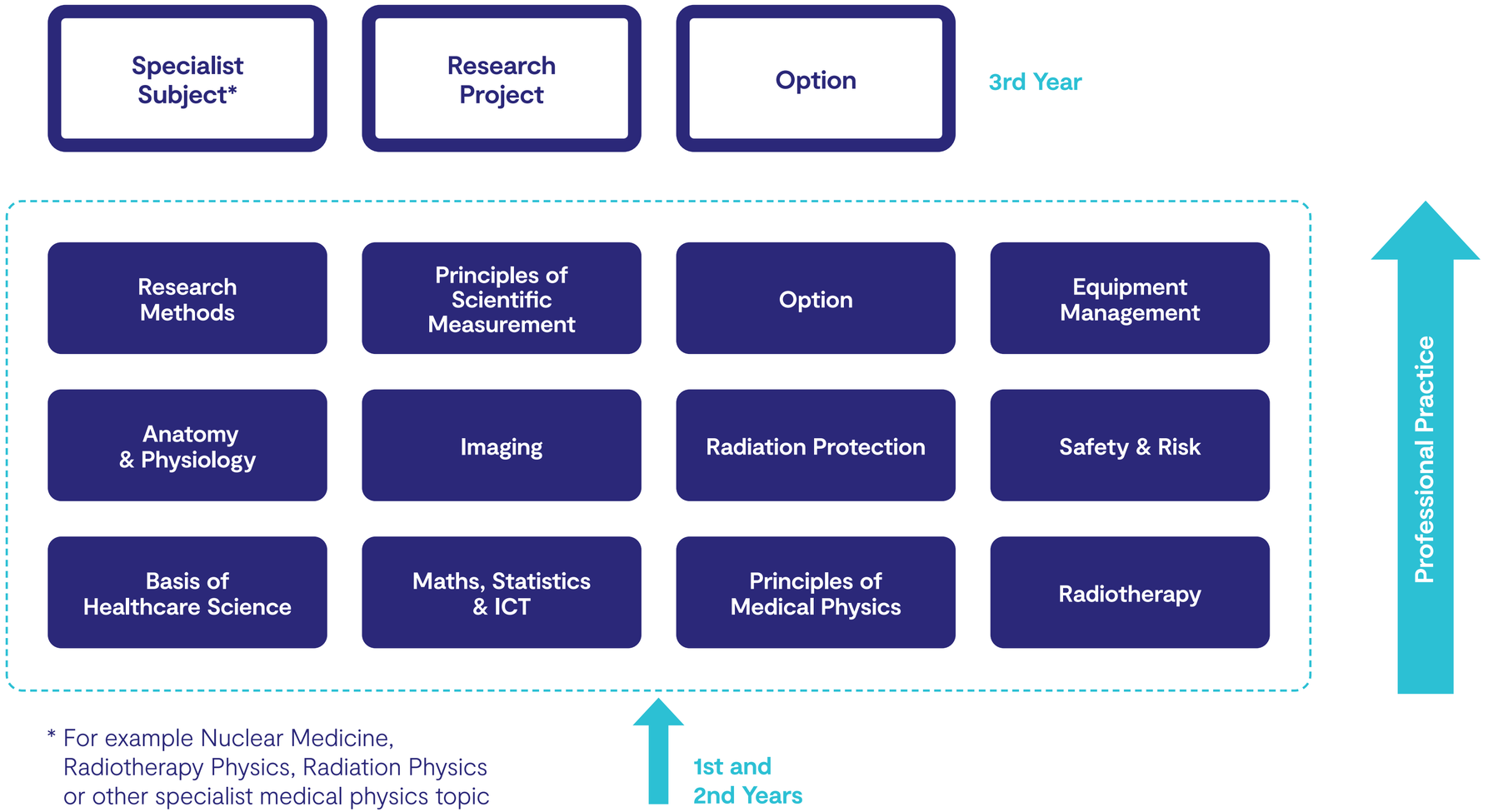
- Accredited programmes are included in the accredited programmes list.
- Accreditation supports the training of clinical technologists and routes to professional registration.
- Where possible, the training team connect graduates with employers and appropriate career and networking opportunities.

2 Summary

2 – Summary

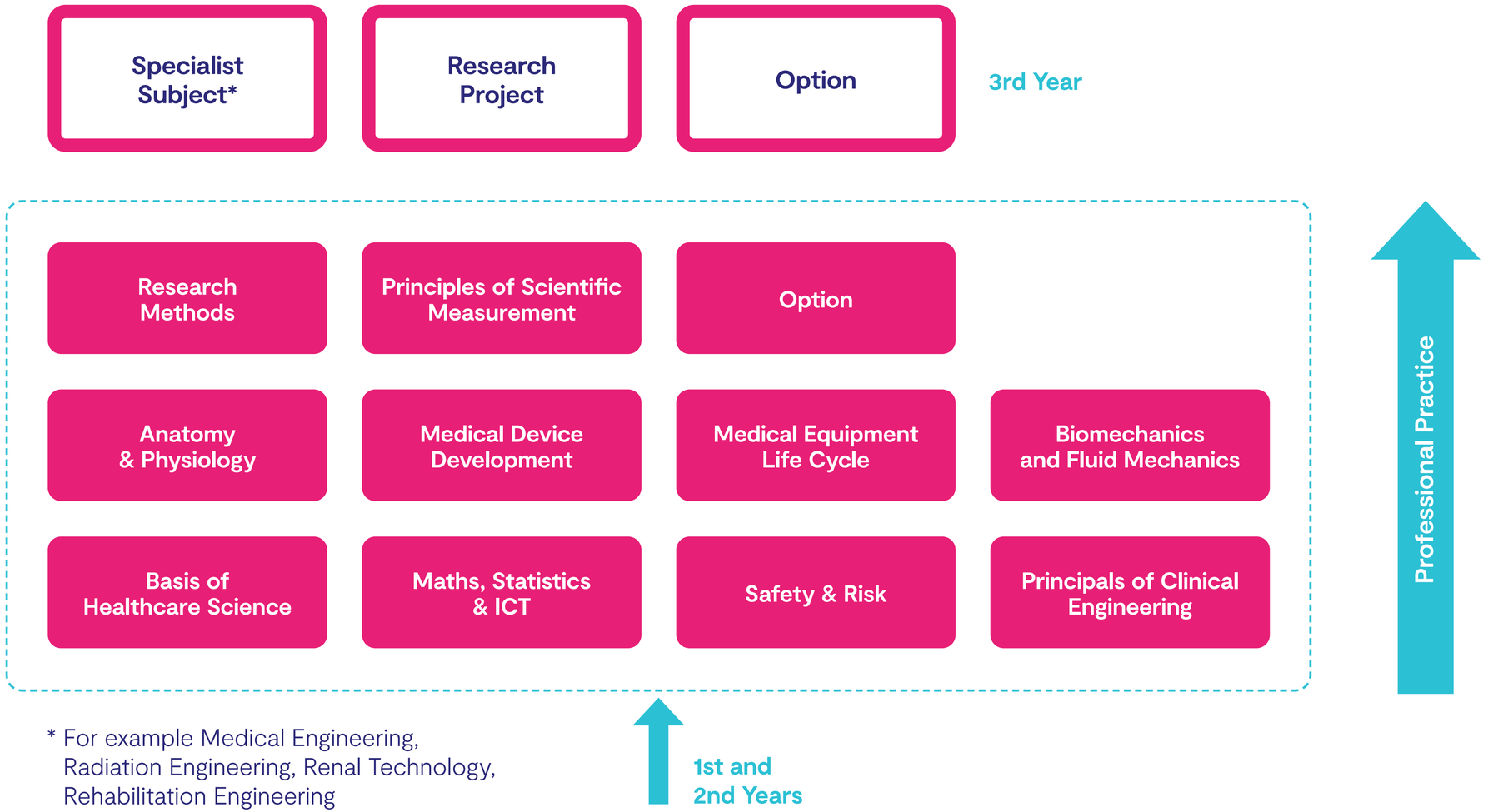
The framework is designed to be split into two streams, engineering and physics and a single programme would typically be accredited against the engineering or physics stream. The framework lists learning outcomes within ‘subject area’ components. However, there is no obligation or expectation for HEI programme directors to deliver content within modules that match these fixed ‘subject area’ blocks; the onus is on HEIs to demonstrate that their programme achieves all the framework learning outcomes for the relevant stream (physics or engineering) and for one or more of the specialities that are considered here. The specialities are, for the physics stream; **Nuclear Medicine**, **Radiation Physics** and **Radiotherapy Physics**; for the engineering stream they are **Medical Engineering**, **Radiation Engineering**, **Renal Technology** and **Rehabilitation Engineering**. Options for module delivery, and the teaching methods to meet this aim, are left to the individual HEI to decide.

Figure 1 (a) The Basic Framework for Medical Physics



* For example Nuclear Medicine, Radiotherapy Physics, Radiation Physics or other specialist medical physics topic

Figure 1 (b) The Basic Framework for Clinical Engineering



* For example Medical Engineering, Radiation Engineering, Renal Technology, Rehabilitation Engineering

2.2 – The Compulsory Component

The Compulsory Component (subjects inside light blue dotted line on Fig 1) contains learning outcomes considered to be essential for being a practitioner physicist or engineer working in medicine or biology. These include Anatomy and Physiology, Maths, Statistics and ICT and Safety and Risk, as well as subjects relevant to either physics or engineering.

Since the authors consider it to be important for students to meet all the learning outcomes covered in the compulsory component, it is not expected that there will be any condoning of modules that deliver ULAF learning outcomes, and no more than a small amount of compensation (i.e. students being allowed to pass a generic module between 30 and 40% if they have done sufficiently well elsewhere).

2.3 – Speciality Component

The Medical Physics study stream includes a speciality component divided into three sections with appropriate learning outcomes. These are **Nuclear Medicine**, **Radiation Physics** and **Radiotherapy Physics**. Physiological Measurement may follow in a later version of this framework. It is expected that a particular programme will concentrate on one of these speciality sections.

The Clinical Engineering stream encompasses four sections within the speciality component with appropriate learning outcomes. These are **Medical Engineering**, **Radiation Engineering**, **Renal Technology** and **Rehabilitation Engineering**.

There is also the possibility that universities may wish to include further options. For example, some points may be awarded for work in suitable non-physics or non-engineering topics that develop workplace or innovation skills.

2.4 – The Research Project Component

The ‘research project component’ is less flexible than other components and is fixed at 30 UK Credit Accumulation and Transfer System (CATS) points, as this is the UK Higher Education sector standard for Framework for Higher Education Qualifications (FHEQ) Level 6[2] qualifications. The project need not cover original research material but must show evidence of the student’s own work and self-direction, with appropriate and qualified supervision. The project should be hypothesis-based work that includes an experimental, computational, or theoretical aspect, as well as a literature review of the field of investigation within its work. This component must be ‘passed’.

Additionally, a talk and a poster activity must be completed by the student during their degree to foster communication skills. These two student activities need not be completed in the same module, or even the same framework component, but one logical approach may be to use the self-directed work of the research project to show individualised student work in posters and/or presentations. At least one of these activities must be assessed summatively.

2.5 – The Entry Qualifications

The assessment of an individual's suitability to enter the programme is up to the HEI but IPEM will seek information on the typical decisions taken by the Programme Director. For example, how many applicants satisfy normal academic qualifications (e.g. A-levels or Scottish Highers or overseas equivalents) and how many are accepted based on professional (workplace) experience.

3.1 ‘Programme-wide’ Learning Outcomes (FHEQ Level 6)

3.1.1 – Programme Outcomes for ULAF Framework

By the end of this degree the student should be able to:

A1. Apply fundamental laws and principles of physics and/or engineering to medical applications, some of which are at, or are informed by, the forefront of the discipline.

A2. Formulate strategies to solve problems in physics or engineering using a variety of experimental, analytical, design, statistical, mathematical and/or computational techniques.

A3. Relate the underlying principles of specialised medical equipment to its routine operation and its common quality assurance procedures.

A4. Demonstrate an awareness of safety principles, risk management and legislative requirements governing best practice in areas of medical physics or clinical engineering.

A5. Apply a range of ICT skills to relevant scientific tasks in medical physics or clinical engineering, such as the use of image processing software, treatment planning systems, electronic or mechanical design principles and medical equipment management systems.

A6. Perform, from initial planning stage to final dissemination of results, an experiment or investigation (requiring a literature review) in a field of medical physics or clinical engineering.

3.1.1 – Programme Outcomes for ULAF Framework

A7. Demonstrate an awareness of the role of medical physics and/or clinical engineering in medicine considering the technological, social and ethical aspects of the field and its development.

A8. Communicate scientific concepts to an audience of his/her peers in a concise, accurate and informative manner, leading to the presentation of logical conclusions at a level appropriate to the audience.

A9. Manage his/her own learning and make selective use of a variety of resources including appropriate texts, research articles and other primary sources in his/her work.

A10. Critically evaluate experimental findings against previous measurement or the scientific literature, in terms of statistical significance and research methodology.

A11. Understand and apply the principles of Good Scientific Practice as outlined in the Academy for Healthcare Science document[3]

3.2 Generic Learning Outcomes (applicable to both streams)

3.2.1 – Basis of Healthcare Science: Learning Outcomes

The student must be able to:

B1. Explain the basis of epidemiology, public health, health prevention and health protection and discuss in relation to the role of the public health function and HCS services

B2. Explain the structure, organisation and evaluate the effectiveness of healthcare services within the student's country of residence.

B3. Explain the principles and core concepts of the sociology of health and illness and discuss those relevant to patients typically referred to HCS services.

B4. Explain the uses of ICT with relevance to healthcare, health and HCS services.

B5. Explain how quality improvement processes can be used to ensure the patient is at the centre of the care delivered

B6. Explain how theories of leadership, team work and communication encourage the development of effective professional attitudes

B7. Keep up to date with developments in healthcare and healthcare science, identifying new and innovative scientific and technical developments and their application in healthcare science.

B8. Describe the principles of patient confidentiality, guidance with respect to medical ethics, and informed consent.

3.2.2 – Maths, Statistics and ICT

The student must be able to:

C1. Understand how mathematics, statistics and ICT are used in medical physics or clinical engineering

C2. Explain how data security and confidentiality are maintained in the clinical environment

C3. Use mathematical techniques such as algebra, exponentials, trigonometry and calculus to produce quantitative results from clinical data.

C4. Use spreadsheets and databases to analyse data and produce graphs of results

C5. Use presentation software to communicate findings to a non-specialist audience using simple concepts such as probability and odds

C6. Explain basic statistical methods e.g. p-values, t-test, correlation, ANOVA

C7. Demonstrate an appropriate level of skill in the use of information and communications technology as stated in Good Scientific Practice[4]

3.2.3 – Safety and Risk

The student must be able to:

D1. Explain the principles underpinning prevailing national and international health and safety legislation

D2. Identify hazards in a given clinical or workplace environment through risk assessment, leading to appropriate advice on best practice

D3. Describe risks and legislative requirements for workplace hazards including non-ionising radiation, ionising radiation, electrical systems, mechanical systems and chemicals in the clinical or workplace environment

D4. Understand the requirement for and use of personal protective equipment

D5. Discuss the sharing of risk information with patients and carers

D6. Be aware of the procedures for reporting and investigating incidents

3.2.4 – Anatomy and Physiology

The student must be able to:

E1. Demonstrate an understanding of the principles of biological organisation, including the structure and function of cells and tissues as well as cell division and growth

E2. Describe the structure and function of the major organ systems of the human body and the physiological basis of human reproduction

E3. Apply knowledge of the terminology and nomenclature of anatomical positioning to clinical scenarios

E4. Apply appropriate anatomical and physiological knowledge to relevant clinical situations where physics and engineering are used in medicine

3.2.5 – Research Methods

The student must be able to:

F1. Understand the way the process of research, innovation and audit improve the outcomes of healthcare procedures

F2. Evaluate the outcome of test results in medical physics or clinical engineering experiments in terms of their statistical significance

F3. Communicate findings for non-specialist audiences using simple concepts such as probability or odds

F4. Understand the research design and methodologies used in scientific literature in the field of physics and/or engineering in medicine

F5. Compare the effectiveness of clinical trial designs in medical physics and bioengineering, distinguishing double-blind, randomised, matched and retrospective designs

F6. Understand how published literature can be effectively searched for previous work

3.2.6 – Research Project

The student must be able to:

G1. Demonstrate self-direction and originality in planning tasks and solving problems during a research project

G2. Prepare a comprehensive review or critical evaluation of existing research literature and/or professional guidance on a specific topic

G3. Evaluate the research findings in relation to applicable techniques, theoretical limitations and experimental or design considerations

G4. Analyse data showing originality in their interpretation in relation to scientific literature

G5. Synthesise appropriate conclusions and findings through knowledge and systematic understanding of the research process and any limitations of the work

G6. Communicate the outcomes of research or product development to professional standards through established dissemination routes, such as a dissertation, poster and oral presentations

G7. Apply ethical considerations in the design and preparation of a research project, complying with local research governance procedures

3.3 Medical Physics Learning Outcomes

3.3.1 – Principles of Medical Physics

The student must be able to:

H1. Formulate and tackle problems, both mathematical and conceptual, involving physical laws and principles, specifically in mechanics, atomic and nuclear structure, dynamics and electromagnetism

H2. Apply relevant physical principles and laws when tackling scientific problems and scenarios.

H3. Describe the electromagnetic spectrum and explain the sources of each type of radiation and the interaction of each with matter

H4. Understand the periodic table, the principles of atomic physics and the different types of radioactivity

H5. Be familiar with the clinical applications of different types of radiation (ionising and non-ionising)

H6. Demonstrate a working knowledge of relevant mathematical concepts to physics and numerical modelling, including calculus, indices, exponentials and logarithms

H7. Demonstrate a comprehensive working knowledge of the SI system of units, conventions for unit prefixes and symbols, and their conversion to other commonly-used units in physics

H8. Demonstrate an understanding of experimental uncertainties and be able to estimate uncertainties in experimental results

3.3.2 – Imaging

The student must be able to:

I1. Describe and explain the principles of operation of a range of imaging modalities including X-rays, CT, ultrasound, radionuclide imaging and MRI

I2. Understand the method of image formation, display and storage and the different methods of image manipulation (including reconstruction, registration and optimisation)

I3. Discuss the advantages and disadvantages and risks and benefits of each modality of each modality and the appropriate use for each

I4. Describe and explain the Quality Assurance (QA) required for each modality

I5. Have a basic understanding of the legislation, standards and best practice relating to the use of each method

3.3.3 – Radiotherapy

The student must be able to:

J1. Describe the different methods of radiotherapy available and discuss the typical use of each

J2. Have a basic understanding of the underlying radiobiology used in radiotherapy and the concept of dose and its measurement

J3. Distinguish the different methods of external beam radiotherapy (linac, orthovoltage, particle) and explain the basic mode of operation of the equipment used for each

J4. Explain the mode of operation of different types of brachytherapy and sealed source therapy

J5. Discuss the dose-depth curves produced by different types of radiation and the basic principles of treatment planning

J6. Identify the role of imaging in modern radiotherapy

3.3.4 – Radiation Protection

The student must be able to:

K1. Describe key radiobiological concepts of ionising radiation, such as stochastic, deterministic, cellular and genetic effects

K2. Explain the different measures of dose (absorbed, equivalent and effective) and their units

K3. Carry out calculations to estimate the risk for different procedures

K4. Assess the precautions necessary to reduce risks to staff and patients such as those arising from the use of medical devices and procedures (e.g. those associated with clinical magnetic resonance systems)

K5. Briefly discuss the mechanisms and level of potential damage from non-ionising radiation exposure (e.g. UV, infra-red and laser, ultrasound) in typical clinical and workplace environments

K6. Explain the legislative regulations relevant to patients, staff and the general public

3.3.5 – Equipment Management

The student must be able to:

L1. Describe each stage of the medical equipment life cycle and management and how this is carried out, with reference to guidance, standards and legislation

L2. Explain the importance and implementation of quality systems in the safe delivery of modern healthcare

L3. Describe and understand QA tests commonly performed on medical equipment

L4. Explain the importance of information governance with respect to radiotherapy equipment

L5. Explain the importance of control of infection and decontamination of medical equipment

L6. Know the processes and regulations relating to the decommissioning and disposal of medical devices

L7. Understand the process of managing safety alerts and incidents relating to medical devices, including the role of the competent national authority and local governance processes, including roles and responsibilities

3.3.6 – Principles of Scientific Measurement

The student must be able to:

M1. Demonstrate an understanding of the principles of scientific measurement, including precision and accuracy, experimental errors (random and systematic) and calibration

M2. Explain the difference between analogue and digital signals

M3. Describe the general arrangement of an instrumentation system, outlining the key components and demonstrate understanding of overall system parameters

M4. Give examples of instruments used to detect radiation and discuss the appropriate use of each

M5. Give examples of methods for measuring physiological signals, especially those required in cardiology and respiratory medicine

3.3.7 – Specialist Learning Outcomes

Students should achieve at least one of the following set of Learning Outcomes depending on their speciality.

3.3.7 – Specialist Learning Outcomes

3.3.7A – Nuclear Medicine

The student must be able to:

NM1. Critically evaluate imaging systems used in nuclear medicine, their performance, uses and applications, QA procedures and their role in the patient pathway

NM2. Describe and explain radiation dosimetry as applicable to nuclear medicine practice. Include knowledge of staff dosimetry

NM3. Explain and critically evaluate the procedures, radiation protection and legislative issues surrounding the administration of radioactive materials with adult and paediatric patients, with particular regard to patient safety and dignity

NM4. Explain the principles of radionuclide production, with reference to the different methods of production

NM5. Critically appraise the problems associated with the assay of radioactive material and the principles of such measurements

NM6. Describe the factors involved in the design of a nuclear medicine department

NM7. Discuss the problems associated with the care of patients undergoing nuclear medicine investigations or treatments

NM8. Appraise a range of radiopharmacy techniques, including generators, isotope properties and blood-labelling techniques

3.3.7 – Specialist Learning Outcomes

3.3.7A – Nuclear Medicine (continued)

NM9. Describe and critically analyse the role of nuclear medicine in the diagnosis of disease, with reference to human anatomy and physiology

NM10. Critically review and evaluate applications of nuclear medicine in terms of diagnosis and therapy for a range of body systems with due reference to patient care needs

3.3.7 – Specialist Learning Outcomes

3.3.7B – Radiotherapy Physics

The student must be able to:

RT1. Examine the role of radiotherapy in the cancer pathway and review tumour pathology of some common tumour sites

RT2. Describe and critically evaluate the principles of radiobiology applied to all types of radiotherapy

RT3. Compare and contrast the range of treatment planning techniques available, and critically appraise the choice of physical parameters required when preparing treatment plans

RT5. Explain target volumes as defined in current national and international standards

RT6. Discuss the requirements relating to patient care in the mould room and specify and appraise factors, principles and constraints that affect treatment regimens and treatment planning

RT7. Discuss the requirements relating to the application of medical imaging to radiotherapy and appraise the choice of imaging technique

RT8. Evaluate radiotherapy equipment and associated QA procedures and systems, including image registration, VMAT, stereotactic and radiosurgery, proton etc., emergency procedures

RT9. Explain the principles of radiation protection in radiotherapy

3.3.7 – Specialist Learning Outcomes

3.3.7C Radiation Physics

The student must be able to:

RP1. Explain the main clinical sources of ionising and non-ionising radiation and their interaction with human tissue

RP2. Evaluate the organisational arrangements for radiation protection and the role of quality management, with particular regard for patient safety

RP3. Critically review and evaluate legislation and codes of practice associated with the control of ionising and non-ionising radiation. Include knowledge of reportable and non-reportable incidents and Diagnostic Reference Levels (DRLs)

RP4. Describe and evaluate risk assessment and emergency procedures of all clinical diagnostic X-ray and non-ionising radiation sources and their role in ensuring patient safety and comfort

RP5. Appraise the safe use of radioactive materials in the clinical environment.

RP6. Explain the principles and methods of performance testing of a range of diagnostic X-ray and non- ionising equipment and their role in ensuring patient and staff safety

RP7. Describe dosimetric methods and critically analyse dose reduction options and the risk benefit to patients

3.3.7 – Specialist Learning Outcomes

3.3.7C Radiation Physics (continued)

RP8. Describe room design and shielding calculations

RP9. Explain the principles and methods of radiation surveys and evaluate methods and options for improvement and dealing with radiation incidents and emergencies

3.4 Clinical Engineering Learning Outcomes

3.4.1 – Principles of Clinical Engineering

The student must be able to:

N1. Explain the basic laws that underpin electricity and magnetism

N2. Explain the fundamental principles of applied mechanics, including Simple Harmonic Motion, and solve basic mechanical problems using the application of force

N3. Describe the SI system of units as relevant to this topic

N4. Explain the legislation and standards that underpin electrical safety of medical devices showing understanding of the contents of the standards, different classification regimes and testing requirements, both in the design and during routine testing protocols

N5. Demonstrate an understanding of the key components of electronic and mechanical systems

N6. Explain the benefits and application of instrumentation amplifiers in medical devices, and the important criteria that dictate appropriate selection, such as Common Mode Rejection Ratio (CMRR)

N7. Explain a range of factors that can influence the physiological signal quality, e.g. noise, bandwidth and impedance

N8. Describe signal processing and signal manipulation, in terms of software processing and electronic processing. Understand difference and limitations of concepts such as averaging and filtering

3.4.1 – Principles of Clinical Engineering

N9. Explain the basic principles of connecting medical devices to computer networks, including knowledge of relevant legislation and requirements

N10. Explain the operation of a selection of simple mechanically operated medical devices such as medical gas apparatus, hoists, and manual handling equipment and suction pumps

N11. Know how to select the appropriate tools to perform basic mechanical workshop tasks, such as fitting, tapping a hole, grinding and applying appropriate torque

N12. Demonstrate an understanding of the main types of equipment used for delivery of Radiotherapy treatment

3.4.2 – Biomechanics and Fluid Mechanics

The student must be able to:

O1. Explain the principles of fluid dynamics and gases in terms of physiological measurement systems, such as urodynamics, invasive blood pressure and respiratory physiology

O2. Describe the structure, mechanical and physical properties of materials used in medical devices such as implants. Discuss biocompatibility and relevant standards that underpin this concept

O3. Explain biomechanical movements and the use of technology to assess disorders of movement, with reference to kinetics and kinematics

3.4.3 – Medical Device Development

The student must be able to:

P1. Know the legislation, standards and governance applicable to medical devices, with reference to the prevailing medical device regulations

P2. Explain the application of quality management and risk management systems to the process of medical device design and modification

P3. Explain the concept and governance requirements around modified or custom-made medical devices

P4. Explain the general requirements for electrical safety of medical equipment and systems

P5. Explain the concept of 'off label' use of medical devices and the governance that underpins such use

P6. Explain the importance of adverse incident investigation and the management of medical device alerts

3.4.4 – Medical Equipment Life Cycle

The student must be able to:

Q1. Describe each stage of the medical equipment life cycle and discuss how it is implemented in healthcare settings

Q2. Explain the purpose of quality management systems in relation to medical equipment management, including the different standards that can be used

Q3. Explain the process of medical equipment procurement and selection with emphasis on national frameworks and tendering

Q4. Create and follow quality management procedures that detail a methodology to commission, repair, maintain, calibrate and quality assure a wide range of commonly used medical equipment

Q5. Explain a range of safety critical examinations to ensure that the medical device is and will remain fit for purpose, taking into account the environment in which it will be used

Q6. Explain the importance of control of infection and decontamination of medical equipment, including invasive devices and also the concept, benefits and limitations of single use devices

Q7. Explain the requirements and regulations relating to the safe decommissioning and disposal of medical devices, including aspects of liability transfer, data protection and prevailing disposal legislation

3.4.5 – Principles of Scientific Measurement

The student must be able to:

R1. Demonstrate an understanding of the principles of scientific measurement, including precision and accuracy, experimental errors (random and systematic) and calibration

R2. Explain the scientific principles that underpin a range of clinical measurements, such as temperature, blood pressure and oxygen saturation

R3. Evaluate a wide range of clinical measurement devices against a ‘Gold Standard’ or other validated device

R4. Explain how physiological signals are converted to an electrical signal and typically displayed, i.e .architecture of a generic clinical measurement system, transducer, isolation Analogue to Digital Converter (ADC), signal processing, display

R5. Explain the different types of transducers used in medical equipment such as electrodes, fluid filled catheters, ultrasound and pressure and flow transducers

R6. Evaluate signal processing techniques such as filtering, averaging, Fast Fourier transform (FFT), explaining the importance of correct techniques for the particular physiological signal of interest

R7. Explain the concept of, repeatability, reproducibility, sensitivity and specificity of measurement methods and concept of tolerances in relation to transducers

R8. Discuss essential items of test equipment linked to one clinical engineering specialism, including the requirements for calibration or verification and traceability to national standards

3.4.6 – Specialist Subject

Students should achieve at least one of the following set of Learning Outcomes

3.4.6 – Specialist Subject

3.4.6A Medical Engineering

The student must be able to:

ME1. Discuss how measurable physiological signals are produced and propagated through the body. Describe production, characteristics and propagation of physiological signals

ME2. Explain and evaluate the safety and functional testing of devices or systems

ME3. Discuss the procedure of managing equipment configurations such as alarm settings and operating limits, considering how the configurations are decided and how they are controlled on devices that are used in a range of different clinical settings, such as adults and paediatrics

ME4. Evaluate different strategies on determining the optimum protocol and frequency of routine safety and functional testing of a range of medical devices, considering risk and optimum use of resources

ME5. Explain the importance of an accurate, complete and up to date medical equipment inventory, justifying the need to keep accurate records

ME6. Explain the governance regarding patient data, with particular emphasis on data stored on medical devices. Consider aspects such as record retention, confidentiality and important considerations when managing data transfer from medical devices to clinical information systems

3.4.6 – Specialist Subject

3.4.6A Medical Engineering (continued)

ME7. Explain the importance and purpose of medical device training for users of medical devices detailing the risks to patient from misuse

ME8. Analyse common causes of interference and the artefacts associated with a range of medical devices, and strategies to investigate and mitigate against them

ME9. Discuss the purpose of medical equipment libraries within a healthcare establishment, highlighting advantages, disadvantages, the type of equipment to be managed via a library and the most effective operating model in terms of how requests are made and executed

3.4.6 – Specialist Subject

3.4.6B Radiation Engineering

The student must be able to:

RE1. Explain the principles of ionising radiation physics and clinical sources of radiation

RE2. Describe radiation protection principles, practices and protocols, including safety requirements, radiation scatter and leakage

RE3. Demonstrate a good understanding of the technologies used in diagnostic and treatment radiotherapy equipment. This should include high voltage (linac) therapy systems, kV imaging systems, and kV therapy systems

RE4. Know the current legislation, standards and guidance relating to the production and use of ionising radiation, including local radiation protection rules

RE5. Describe the principles that underpin the operation of radiation imaging and radiotherapy treatment equipment, including the characteristics and choice of appropriate radiation fields used for treatment

RE6. Identify the basic environmental requirements needed to support ionising radiation imaging treatments, e.g. room design, shielding, interlocks

RE7. Critically evaluate new technology (eg. MRI, Proton Beam Therapy) and applications of existing technologies to be used in imaging or therapeutics

3.4.6 – Specialist Subject

3.4.6B Radiation Engineering (continued)

RE8. Explain the use of computers in the delivery of radiation imaging and treatment, including their use for delivery of highly complex 3D volume treatments, and for imaging verification of accurate treatment delivery

RE9. Explain the importance of quality systems and justify the need for accuracy in documentation and records

3.4.6 – Specialist Subject

3.4.6C Renal Technology

The student must be able to:

RN1. Explain the anatomy, physiology and pathophysiology of the urinary system, including common renal diseases and the impact on the patient

RN2. Discuss the principles, methods and limitations of dialysis equipment and obtaining vascular access and anticoagulation to support haemodialysis

RN3. Compare and contrast the modalities of Renal Replacement Technology (RRT), including peritoneal dialysis, intensive care and transplantation

RN4. Demonstrate a knowledge of the units of measurement used in water quality testing and renal technology. Discuss and evaluate the standards that apply to water quality available through the municipal systems, and those that apply to dialysis fluids

RN5. Explain and evaluate water and dialysis fluid quality monitoring and testing procedures, including the implications of changes in the water quality due to supply changes

RN6. Describe and evaluate dialysis performance assessment tools, including dialysis adequacy, biofeedback and treatment individualisation, and how they influence treatment

RN7. Explain the reasons that influence choice of dialysis fluid composition

RN8. Appraise the current renal dialysis standards and guidelines and their application in healthcare environments

3.4.6 – Specialist Subject

3.4.6C Renal Technology (continued)

RN9. Discuss the impact of renal disease, illness, disability and dialysis complications on patients and their families

RN10. Discuss the role of dietary control in the management of renal disease

RN11. Explain the specific health and safety procedures within the RRT environment, including the risks to staff and patients, ensuring these encompass infection control issues and how to minimise the totality of risks

RN12. Describe and evaluate the impact of renal technology engineering services on the clinical pathway and outcome

RN13. Discuss, justify and critically appraise safety and functional testing procedures for devices used within the RRT environment and the implications of providing RRT in different settings. Electrical safety of haemodialysis equipment is unusual in that most haemodialysis machines are Type 1 class B, but they need to fulfil the electrical safety requirements of type CF equipment. This requires particular consideration that may not be adequately covered in the generic teaching of electrical safety testing and should be given emphasis in the renal technology module

3.4.6 – Specialist Subject

3.4.6D Rehabilitation Engineering

The student must be able to:

RH1. Describe the impairments and associated conditions that result in referrals to rehabilitation services

RH2. Discuss the role of the rehabilitation engineers in a multidisciplinary approach to high-quality, patient-centred and safe rehabilitation services

RH3. Describe and analyse human movement (e.g. gait) and solve quantitative biomechanical problems

RH4. Explain the use of biomechanical analysis, including finite element analysis, in assessment and assistive technology design

RH5. Compare and contrast manufacturing techniques used in rehabilitation engineering such as subtractive verses additive manufacturing

RH6. Compare and contrast the properties of a range of commonly used materials (including foams) used in rehabilitation engineering

RH7. Explain the key elements of design (including risk assessment, critical evaluation) of rehabilitation technology devices

RH8. Explain the importance of design and material selection on clinical issues such as infection control

RH9. Describe the quality managements systems, including quality control and audit, used to ensure regulatory requirements are met and maintained

3.4.6 – Specialist Subject

3.4.6D Rehabilitation Engineering (continued)

RH10. Critically appraise a range of assistive technology solutions, including mobility (e.g. wheelchairs), posture control, environmental control and communication aids

RH11. Explain the limitations in the functionality and application of commonly used assistive technology devices (e.g. lower limb prostheses) from a user's perspective

RH12. Discuss the adjustment and adaptation of assistive technology devices in relation to the medical device regulations

RH13. Discuss the range and use of measurement technologies (e.g. motion capture, pressure mapping) used in assessment and explain how these impact on the prescription of assistive technology devices and treatments

3.5 ‘Specialist Component’ Learning Outcomes (FHEQ Level 6)

3.5 – ‘Specialist component’ Learning Outcomes (FHEQ Level 6)

To be submitted by individual HEI programme directors for each specialist module. Further guidance for HEI programme directors and assessors is found in Section 1.2.2 of this document.

These learning outcomes are written by each HEI and will be scrutinised in detail during accreditation assessments. Each should link to ’programme-wide’ learning outcomes found from page 8 and be labelled accordingly with the link (e.g. [A10]).

4 Applications for Accreditation

Applications for Accreditation

Expressions of interest should be sent to training@ipem.ac.uk and applications are encouraged from HEIs within the UK and from other countries. A range of programme titles may be acceptable for accreditation.

The Site Visits

Typically, the site visit will involve two assessors (at least one of whom will be an academic) per HEI accreditation application and will take place over one working day. It should be viewed as an exercise in outlining the programme to an unfamiliar academic colleague and used as an opportunity to clarify the information within the accreditation documentation. The assessors will normally be in contact with the programme director to arrange a date for the site visit and to determine a suitable itinerary.

The itinerary for the assessors' visit is the primary responsibility of the individual assessors but the following is a list of possible elements that have proven useful in previous evaluations:

- Initial meeting for discussion and feedback with staff holding key responsibilities, including short initial presentation from the programme director outlining the programme(s)
- Subsequent discussion of aspects of the programme with as many teaching staff as possible
- Demonstration of any innovative aspects of teaching delivery
- Demonstration of how communications skills will be learned (i.e. talk/poster)
- Private inspection of examination material, some marked scripts and project material
- Private discussion with a selection of students
- Private time for assessors to consider their decisions
- Final meeting to examine accreditation documentation with the programme director

References

[1] The revised UK Quality Code for Higher Education (2018) https://www.qaa.ac.uk/quality-code (Accessed December 2020

[2] https://www.qaa.ac.uk/docs/qaa/quality-code/higher-education-credit-framework-for-england.pdf

[3] AHCS Good Scientific Practice Standards (GSP) (2020 https://nshcs.hee.nhs.uk/knowledgebase/ahcs-good-scientificpractice-gsp-standards/ References 59

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