UNIVERSITY OF CAMBRIDGE

Programme Specification

Postgraduate Certificate in Healthcare Innovation

Postgraduate Diploma in Healthcare Innovation: Engineering, Systems and Improvement

Master of Studies in Healthcare Innovation: Engineering, Systems and Improvement

	Awarding body	University of Cambridge
	Teaching institution	University of Cambridge
	Accreditation details	None
	Name of final award	Master of Studies (MSt)
		Postgraduate Diploma (PgDip)
		Postgraduate Certificate (PGCert)
	Programme title	Healthcare Innovation (PgCert)
		Healthcare Innovation: Engineering, Systems and Improvement (PgDip and MSt)
	HECoS code	TBC
7	**Relevant QAA benchmark statement(s)**	None
8	**Qualifications framework level**	FHEQ Level 7
9	**Date specification was produced**	April 2022, August 2022

Introduction

The Healthcare Innovation programme is a part-time set of courses designed to fit with the demands of full-time employment. The course is delivered through a combination of face-to-face and sessions requiring attendance in Cambridge, online sessions and self-directed learning and the course is supported through a virtual online environment.

The objective of the programme is to provide an introduction to the research skills, governance and innovation needed to work successfully with healthcare systems, suitable for those from engineering and medical backgrounds, as well as related areas. Students will be equipped with the skills necessary to understand how biomedical engineering impacts upon populations, health conditions and clinical outcomes, and learn how to work across the boundaries of engineering, design and healthcare in an effective manner. The programmes have been developed by a network of partners with unrivalled experience in healthcare systems and biomedical engineering to create a world-leading training environment.

The course is structured such that students can progress from the PgCert, through the PgDip and then on to the MSt in a flexible manner, enrolling each year for the corresponding award if they choose to progress, with breaks allowed along the way.

Educational aims

The course aims to:

- Provide professionally relevant teaching and learning of the knowledge and skills necessary to be at the forefront of efforts to engineer better care
- Develop healthcare innovation experts with the necessary expertise, and originality of application, to pursue and expand their roles in the rapidly evolving environment of healthcare systems
- Promote a comprehensive understanding of the practical and ethical considerations relevant to healthcare improvement and biomedical engineering

- Provide work-relevant learning around the current problems, best-practice, challenges and potential solutions in the delivery of effective health and care
- Create a professional network of like-minded individuals as leaders in the field of healthcare systems and biomedical engineering
- Provide students with systems leadership skills and the knowledge to use technology to deliver value in healthcare, research, and commercial arenas
- Equip graduates with the language and mindset to work in an interdisciplinary manner across the interface between medicine, engineering and commercial settings.
- Expose students to the industrial context and perspective within the technology area, providing opportunities throughout the study for involvement with industrial partners through workshops, seminars and the projects.

Target students and admissions criteria

The courses are targeted at both mid-career and new graduates who wish to develop their knowledge and skills in the healthcare innovation field. The part-time nature of the courses are designed to fit around the demands of full-time employment The courses are broadly based and inter-disciplinary and students from any technical or healthcare-related discipline are welcomed. It is expected that an applicant's first degree will be in a subject relevant, or related to, life sciences, medical sciences, computation or engineering, but other backgrounds will be considered. The courses are structured to accommodate a range of backgrounds, but enthusiasm for learning new methodologies, technologies and approaches to healthcare innovation will be important.

Students will be expected to have having obtained a first or upper second-class honours degree (or equivalent), with an English language qualification for non-native speakers.

The structure of the courses allows international students to attend on Student Visitor Visas and those in full-time employment, whether in the UK or abroad, to work and study at the same time.

Learning outcomes

Knowledge and understanding

PgCert, PgDip and MSt
- Knowledge of the broad landscape of healthcare systems and biomedical engineering; and understanding of the practical and ethical considerations relevant to healthcare improvement and biomedical engineering. (Learning outcome K1)
- Knowledge of engineering techniques that can be applied to address challenges in clinical settings, including diagnostics and medical devices. (K2)
- Understanding the role of each key element in healthcare improvement projects. (K2)

PgDip and MSt
- Understanding and knowledge of patient and public health from the aspects of physical, environment, social, legal and historical elements. (K4)
- Understanding the value of a mixture of healthcare technology in design implementation for clinical purposes. (K5)
- Understanding of the intricacy of medical device development for both medical settings and everyday life; and understanding of the up-to-date technical, legal and ethical infrastructure that guides research and commercial development. (K6)

MSt

- More in-depth knowledge and application of the methods taught in units 1 to 6 as applied to healthcare innovation via the MSt thesis practice, which must address a topic in the space of scientific, medical, social or business innovation under the general theme of healthcare support. (K7)

Intellectual skills

PgCert, PgDip and MSt

- Ability to identify the future trends in healthcare provision, biomedical interventions and use of healthcare data; and communicate to appropriate groups to support the implementation of change. (Learning outcome S1)
- Expertise to apply engineering knowledge and methodology in the complex multi-professional systems. (S2)
- Skills to use the relevant tools to execute systems approaches in healthcare improvement projects. (S3)

PgDip and MSt

- Ability to conduct appropriate epidemiological study analyses and formulate/test appropriate hypotheses. (S4)
- Ability to identify the space to improve diagnosis, treatment, management and policies in clinical practice with a strong advanced technical competence. (S5)
- Key entrepreneurship mindset and skills to complete a healthcare product business life cycle. (S6)

MSt

- The research project requires further extensions of the student's knowledge and skills and an increased intensity of study comparing to PGCert and PGDip. This will lead to a synoptic overview of the course units and an ability to execute a research project covering the entire process from initial curiosity-driven healthcare innovation queries through to a potential solution. (S7)
- Ability to plan a research project, incorporating the relevant background and literature and identifying appropriate research goals and research methodology. (S8)

Transferable skills

- Professionalism to work in a diverse environment, work value, ethics and sociability, including embracing differences in professional background, culture, language, geography.
- Not constrained to familiar technology or hard skills, but also the flexibility to adapt to changes.
- Ability to develop and apply research critically to improve health for individuals, populations and healthcare system.
- Capability to disseminate and translate knowledge for patient and public benefit.

Employability skills

- Be able to take the responsibility at the frontiers of organisations with a sharp sense of new opportunities and awareness of the coming trends.

- Knowledge to improve organisation's performance, competitiveness and advancement.
- Skills to facilitate effective and timely decision making within an organisation in healthcare settings.
- Leadership proficiency to create and close the business loop of design innovations across a diverse range of healthcare contexts.

Programme structure

The programme is part-time and follows a "stacked structure" such that students progress from the PgCert, through the PgDip and then on to the MSt, enrolling each year for the corresponding award. Progression through the structure will be dependent on obtaining a pass at the end of each year. Breaks will be allowed between years in a flexible manner, up to a maximum overall course duration of 8 years. Students will be affiliated to colleges in their final MSt year.

The MSt course consists of six units and a research dissertation, with Units 1-3 comprising the PgCert and Units 1-6 comprising the PgDip.

Each unit in the PgCert and PgDip years will be associated with a residential week which will be carried out in Cambridge. Teaching outside the residential weeks will be supported by online lectures/seminars, supervisions and online resources.

Unit 1: Research skills and innovation [20 credit]. This unit provides the landscape to understand the breadth of patient level data in the healthcare and economic landscape in the UK and globally.

Unit 2: Healthcare Technologies I [20 credit]. Essential healthcare technologies and biomedical engineering knowledge in a wide range of applications are covered in this unit. Major topics include biomaterials, biofabrication and manufacture for biomedical applications, and biosensors and wearables.

Unit 3: Healthcare systems improvement [20 credit]. This unit applies a systems engineering approach to the process of changes in the healthcare environment, allowing an in-depth understanding of the elements and interrelations in the healthcare system and consequences of any change.

Unit 4: Patient and population health [20 credit]. This unit revolves about public health now and in the future, covering aspects of physical, social, legal, and historical elements, and many more essentials to develop evidence for the improvement of society health and wellbeing.

Unit 5: Healthcare Technologies II [20 credit]. To enrich the ability to bridge between engineering and healthcare innovation, this unit expands the range of healthcare technologies and applications, including topics in biomechanics, image analysis methods and implantables.

Unit 6: Healthcare system innovation [20 credit]. This unit is designed to equip the students with the entrepreneurship skills and mindset to go along with the development of medical technology innovation. It links closely with the other five units, enabling the students to execute a medical technology or process innovation in the modern healthcare ecosystem.

Research Dissertation [60 credit] The final MSt year will require submission of a research dissertation, of between 10,000 and 12,000 words in length including footnotes but excluding appendices and bibliography. The research project must address a topic in the space of scientific, medical, social or business innovation under the general theme of healthcare. The dissertation should be written with a focus towards the innovative aspects of the project

underpinned with a strong understanding of the technologies or policies. The dissertation should include primary data. This may be quantitative or qualitative in nature.

Teaching methods

Teaching methods will include lectures, student and tutor-led seminars, small group teaching and supervisions, guest speaker sessions, group discussions and workshops, practical sessions, transferable skills workshops, team building sessions, independent research, coursework projects, case studies, and an individual research project leading to a dissertation.

Each unit in the PgCert and PgDip years will be associated with a residential week which will be carried out in Cambridge. Students will be required to attend and engage in all the residential week sessions. Teaching outside the residential weeks will be supported by supervisions (normally online) and online resources.

Teaching in the MSt year of the course will be predominantly online. Each student will be assigned a project supervisor who will provide regular monthly online supervision during the research project. This will be supplemented by group sessions/seminars to provide research skills training. MSt students will be required to attend in Cambridge for two two-day activities: presentation of their research project plans at the start of the year and presentation of their research findings towards the end of the year. Other year groups will be invited to attend the final presentation conference to provide the opportunity to mix across year-groups, so enhancing networking.

Assessment

Residential week sessions
Attendance in all residential week sessions will be compulsory in principle, although a system of allowances will be in place to consider accommodating situations where this is not possible. The unit leader will confirm that students have attended and engaged in all the sessions.

Unit assessment
Units 1 to 6 will use summative assessment approaches designed to ensure experiential learning and work-based real-life relevance. The exact assessment method used will depend on the material in the unit, to match the different learning outcomes.

In units 1, 3 and 6 the assessment will be in the form of a written report of between 3,000 and 4,000 words, in which the student will be required to demonstrate a broad knowledge and understanding of the topic areas covered in these units. The report for unit 1 (Research skills and innovation) will require students both to demonstrate knowledge of the broad landscape (learning outcome K1) but also show how this landscape will affect future trends in healthcare innovation (S1). For Unit 3 (Healthcare systems Improvement) the report will require students to apply a system engineering approach to improvement (S3), demonstrating an understanding of the interplay between different key elements in the process (K3). In unit 6 (Healthcare systems innovation) the factors affecting research and commercial development of healthcare innovations will be considered in the report (K6), with the students being required to demonstrate the mindset and skills to follow through on a product business life cycle (S6).

Unit 4 (Patient and population health) will have a similar written report requirement of 3,000-4,000 words, where aspects of patient and public health will need to be addressed (K4), but will also include statistical or epidemiological analysis within the report (S4).

Units 2 and 5 (Healthcare Technologies I and II) will each be assessed using a set of short reports (three reports per unit, each of length 4 pages including figures and tables). This assessment method ensures that the range of separate topic areas in these units are covered (K2, K5) and that students can apply techniques in a healthcare setting (S2), and use their technical competence to identify scope for improvement in healthcare practice (S5).

Research project assessment (MSt only)
The assessment of the research project will include a planning report of up to 3,000 words and a dissertation of between 10,000 and 12,000 words in length including footnotes but excluding appendices and bibliography. As well as demonstrating the ability to plan a research project (S8), the planning document will require students to put their research into the context of future trends (S1), and demonstrate a good understanding of how a systems approach affects the ability to innovate (S3). The research dissertation will require students to have a synoptic overview of the course units in executing their project plan (S7), using a more comprehensive knowledge and application of the methods taught in units 1 to 6 (K7). Both the planning and final research outcomes will also be assessed by oral presentations. A tailored marking guideline ensures the quality of the research project, which in turn ensures that the corresponding learning outcomes have been met.

These assessment methods and the marking structure will enable students with disparate backgrounds (e.g. engineering and medicine) to demonstrate that they have achieved the learning outcomes in a flexible way, taking advantage of their background skills and knowledge.

The PgCert, PgDip and MSt awards will be awarded either as 'Pass' or 'Distinction'. Students will be required to pass the PgCert to progress to the PgDip, and pass the PgDip to progress to the MSt. Students will exit with the highest of all awards achieved. Once awarded, a student holds that award until and unless they are readmitted to undertake the next component course in the stacked programme. On being readmitted, a student must surrender their award to the admitting body, who will arrange for delivery to the central Student Registry. Should a student subsequently fail or withdraw from the course, the Exam Board will authorise the restoration of the surrendered award. To obtain a Pass, students will be required to achieve the following components:

- a mark of 60% or greater in each of units 1 to 3 (PgCert) or in each of units 1 to 6 (PgDip and MSt)
- a mark of 60% or greater in the dissertation (MSt)

Cases of marginal failure (i.e. 55%-59%) in one unit may be redeemed by high performances (i.e. an average mark of over 70%) in the other units in that group, grouping units 1-3 and 4-6 together. Cases of marginal failure (i.e. 55%-59%) in the Dissertation may be redeemed by high performance in the units, i.e. a mark over 70% averaged over units 1 to 6. In cases where there has been marginal failure in one or more components, further assessment may be undertaken through an oral examination. The Board of Examiners will then use all available examination information, including the oral examination, to determine whether the candidate's work is of the requisite standard to merit the PgCert, PgDip or MSt award. Students who achieve at least 75% averaged over the units (1 to 3 for PgCert, 1 to 6 for PgDip) and, for the MSt, at least 75% in the Dissertation, will be awarded a Distinction.

Allowances
Suitable allowances and adjustments will be applied in case of serious problems affecting study, including illness, bereavement and financial hardship.

Support for students and their learning

The Engineering Department conforms to the University's Code of Practice for Taught Master's students and Research Students.

The following tools will be provided to support the students:
- All students will be assigned a Course Advisor.
- MSt students will be assigned a research project supervisor
- The Course Director will provide a direct point of contact.
- An induction programme will help students start out on the course effectively
- Handbooks, including syllabus, teaching and supervision schedules, will be provided so that the students can arrange their study accordingly.
- Online teaching support will be offered outside teaching hours.
- Electronic course materials, including lecture recordings and notes, will be provided for revision purposes

Ensuring an effective academic community
The structure of the course gives an excellent opportunity to provide a network of people with diverse skills and backgrounds. The course structure aims to ensure that this network is firmly established at the outset in the first residential week, and is reinforced through the year away from Cambridge. The first week will include induction sessions from the academic leads, the Course Director, and our library team as well as social events and a course dinner. In addition the induction programme in this first week will remind students of critical research tools, including library resources, analytical tools, communication skills and confidence in engaging in discussion needed to thrive in an academic environment.

Academic support away from the Cambridge environment
Online resources tools, including the Engineering Department website and Moodle, will be used to support continued learning while students are away from Cambridge. Discussion fora will be established on moodle to provide a platform for both strictly academic discussions and for themes more related to welfare. These online tools will be reinforced by use of regular online Teams one-to-one supervisions with the assigned Course Advisor and by use of interactive workshop-style online sessions embedded in the course during the term.

Welfare and mental health support
Academic and professional staff will provide pastoral welfare support and signposting of students to appropriate experts. The course will be structured both to encourage students to seek help where required, and to provide a mechanism for faculty to identify students in need of help. Several mechanisms will be used for providing the required support. Course Advisors and the Course Director will provide immediate and local advice. Colleagues in the Engineering Graduate Office will support the local course team, building on their expertise in supporting the many graduate students in the Department. Where urgent or ongoing expert support is required, the Course Director and the Graduate Office will provide guidance and information signposting students to appropriate healthcare professionals.

Disability support
Disability support will be provided via a formal system to provide standard adjustments, managed by the Engineering Degree Committee. For complex cases the University's Disability Resource Centre or an external professional advisor will be approached to advise.

Management of teaching quality and standards
Management of the quality of the course is the responsibility of the Course Director. Students are encouraged to give immediate verbal feedback to staff teaching on the programme and to the Course Director. Feedback channels are also formally implemented through a Staff-

Student Liaison Committee, attended regularly by the student representatives. Students are also asked to complete quantitative and qualitative feedback questionnaires, which address questions on the following issues:

• Quality of teaching
• Quality of visual aids and teaching environments
• Relevance of subject matter
• Workload
• Assessment and feedback
• Admissions process
• Relevance to expectations
• Facilities (study space, IT, library resources etc.)
• Quality of administrative support

Results of questionnaires will be distributed to the relevant teaching staff. A summary of the quantitative feedback results will be discussed by the Staff-Student Liaison Committee and any action points from such discussions will be noted in the Minutes and followed up at subsequent meetings, as well as forwarded to the Course Management Committee.

The academic content of the programme will be continually reviewed by the Course Director, and strategically reviewed at the end of each year of operation by a Course Management Committee. Any significant changes proposed will be considered by the relevant committees. The quality of the programme will also be monitored by an External Examiner who will observe aspects of the course operation during the year and attend the annual examiners meeting and submit a report to the Vice Chancellor's Office.

Graduate employability and career destinations

Preparation for employment in general is provided in the opportunities for the acquisition of relevant transferable and employability skills outlined in this programme specification.

The Careers Service maintains links with relevant employers and takes into account employer needs and opinions in the services which it provides for matriculated MSt students. The Careers Service also allocates a Careers Adviser to each College, Faculty and Department to act as a point of contact.

The structure of the course will allow significant opportunities for students to adjust and refine their career goals. The course awards provide a direct route to career enhancement. During the course, networking opportunities will be offered, exposing students to a wider range of career opportunities both from their fellow students but also their Course Advisor, mentors on the course, including clinicians, clinical engineers and industrial colleagues.