Programme Specification: Post Graduate Taught

For students starting in Academic Year 2023/24

1. Course Summary

Names of programme and award title(s)	MSc Medical Engineering Design
Award type	Taught Masters
Mode of study	Full-time Part-time
Framework of Higher Education Qualification (FHEQ) level of final award	Level 7
Normal length of the programme	1 year full-time or 2 years part-time
Maximum period of registration	The normal length as specified above plus 3 years
Location of study	Keele Campus
Accreditation (if applicable)	n/a
Regulator	Office for Students (OfS)
Tuition Fees	**UK students:** Full-time fee for 2023/24 is £11,500 Part-time fee for 2023/24 is £6,400 per year* **International students:** Full-time fee for 2023/24 is £21,900

How this information might change: *Please read the important information at http://www.keele.ac.uk/student-agreement/. This explains how and why we may need to make changes to the information provided in this document and to help you understand how we will communicate with you if this happens.*

* *We reserve the right to increase fees in subsequent years of study by an inflationary amount. Please refer to the accompanying Student Terms & Conditions for full details. Further information on fees can be found at http://www.keele.ac.uk/studentfunding/tuitionfees/*

2. Overview of the Programme

The aim of the programme is to enable students from non-engineering undergraduate degrees to undertake professional careers as Medical Device Designers in the healthcare industries. There is a recognised shortage of engineers across the UK as a whole1. Furthermore, the Institution of Mechanical Engineers[1], for example, recognise a distinct bias towards the male population and are looking to schemes to address the shortfall by also addressing the gender imbalance. They have suggested that awards more directed towards engineering creativity (i.e. Engineering Design) may assist with both. This programme has been developed to meet these requirements but also of industry, as highlighted by HEFCE and the Engineering Council[2].

Engineering design can have a variety of impact points on medical practice, from the introduction of new devices to change in policy and practice. This MSc has been designed to allow students to specialise in the creative, problem solving engineering design discipline; but within the context of healthcare and clinical practice. Hence, producing designers who are both familiar with the clinical environment but who also understand its specific

contextualisation. Keele is in an ideal position to deliver such an award based on its long-standing relationship with the NHS and its highly rated Research Institute, the Institute for Science and Technology in Medicine. Both have worked together to produce novel devices that are now in the market place; hence there is an opportunity to pass these skills on to the next generation of engineering designers allied to the healthcare profession.

For example, the NHS is becoming increasingly aware of energy management issues[3]: recent studies illustrate that they are the largest consumer of energy in the public sector (in 2009 circa 1/3 of the total CO2 output from public buildings was from hospitals[4]). Even small changes in healthcare devices design and procedures can reduce this CO2 burden, and not just changes in estate. Students graduating from this award will be able to provide solutions and be at the forefront of the drive to "effort reduction" within healthcare.

Engagement with our postgraduate programme will enable participants to further develop their intellectual, personal and professional capabilities. At Keele, we call these our ten Graduate Attributes and they include independent thinking, synthesizing information, creative problem solving, communicating clearly, and appreciating the social, environmental and global implications of their studies and activities. Whilst participants will undoubtedly have already developed these skills and abilities to varying degrees, such existing capabilities can always be deepened and enriched. Our educational programme and learning environment is designed to help participants to develop further as a well-rounded postgraduate who is capable of making a positive and valued contribution in a complex and rapidly changing world, whichever spheres of life they engage in during and after their studies at Keele.

[1] S Tatlow, IMechE - Keele visit, 23-2-2016

[2] Engineering Council, Engineering Professors Council. (2014). Transition to Engineering. (Accessed from http://www.hefce.ac.uk/pubs/rereports/Year/2015/Engineering/Title,105476,en.html)

[3] NHS, The NIHR Carbon Reduction Guidelines, October 2010

[4] The Guardian, 2009, accessed from http://image.guardian.co.uk/sys-files/Guardian/documents/2009/12/31/BuildingCO2.pdf

3. Aims of the programme

The educational aims of the programme are designed primarily with student satisfaction at the forefront. Within this we endeavour to provide an environment where students are motivated to develop academically, personally, and professionally. Teaching is designed to provide a multidisciplinary perspective that encourages professional development beyond current specialities and growth into new areas. An area of particular importance to our course is training in the development of critical and evaluative thinking alongside refinement of writing and communication skills for application in individual research and team working scenarios. Through the development of these new and essential skill sets the student can expect to feel comfortable transferring scientific knowledge from theory into practise and to empower life-long learning.

4. What you will learn

The intended learning outcomes of the programme (what students should know, understand and be able to do at the end of the programme), can be described under the following headings:

- Subject knowledge and understanding
- Subject specific skills

Subject knowledge and understanding

Successful students will be able to demonstrate:

1. an understanding of the core engineering principles within the context of engineering design practice,
2. an understanding of design methodologies and quality management issues,
3. modelling techniques commensurate with the role of a medical device designer,
4. an understanding of statistics and its role in research methods and design quality,
5. an understanding of the role of the engineer in society
6. knowledge of the generic, contextual principles supporting effective medical device design,
7. knowledge of associated environments and new technologies,
8. a critical awareness of technologies in their chosen pathway will develop towards the point where students will comfortably assist in the process of developing research projects, new devices and new solutions.

Taken together the student will have:

9. developed the capacity to transfer scientific knowledge into practical application in medical devices design or their personal career choice.

Subject specific skills

After successful completion of the Master's programme the student can expect to demonstrate a broad range of newly gained Academic and Professional Skills. These will be:

10. an understanding of research process and evidence based practise,

11. a demonstrable ability to challenge, evaluate, modify, and develop the theory and practise surrounding engineering design,

12. the ability to synthesize and evaluate information obtained from diverse sources and settings,

13. the ability to identify personal and professional requirements in order to support lifelong learning,

and

14. the ability to plan and manage projects.

In addition the MSc in Medical Engineering Design has been developed with the requirements of the Engineering Council UK-Spec as a "matching section" towards professional engineering qualifications for those with an accredited first degree in engineering.

Keele Graduate attributes

Engagement with this programme will enable you to develop your intellectual, personal and professional capabilities. At Keele, we call these our ten Graduate Attributes and they include independent thinking, synthesizing information, creative problem solving, communicating clearly, and appreciating the social, environmental and global implications of your studies and activities. Our educational programme and learning environment is designed to help you to become a well-rounded graduate who is capable of making a positive and valued contribution in a complex and rapidly changing world, whichever spheres of life you engage in after your studies are completed.

Further information about the Keele Graduate Attributes can be found here: http://www.keele.ac.uk/journey/

5. How is the programme taught?

Teaching is delivered primarily through seminars, group work, lectures and associated web-based Virtual Learning Environment materials. These are accompanied by tutor-led tutorials, laboratory-based practical sessions, seminars by nationally and internationally known scientists or engineers or clinicians, workshops, problem-solving scenarios, dedicated research project supervision and site-visits. Reflective of postgraduate education self-directed learning is also a major component during both full-time and part-time studies.

Evaluation of learning outcomes is met through a broad range of assessments. These include coursework-based essays, reports on laboratory-based practical experiments, written examinations, interactive oral presentations, and a dissertation based on the student research project.

6. Teaching Staff

The programme team consists of existing academic staff delivering on Masters Programmes in Biomedical Engineering, Cell and Tissue Engineering and Sustainability.

The University will attempt to minimise changes to our core teaching teams, however, delivery of the programme depends on having a sufficient number of staff with the relevant expertise to ensure that the programme is taught to the appropriate academic standard.

Staff turnover, for example where key members of staff leave, fall ill or go on research leave, may result in changes to the programme's content. The University will endeavour to ensure that any impact on students is limited if such changes occur.

7. What is the structure of the programme?

The Medical Engineering Design Master's programme is illustrated below. Students may opt to start in September intake or January intake with no detriment to their studies. Compulsory modules provide the backbone of engineering design and research principles that enable students to progress to an engineering design biased, industrially informed, dissertation. Specific underpinning knowledge is provided by the ability to select 2 optional modules. This optional element structure allows students to tailor the learning experience towards individual requirements and strengths.

There are SEVEN compulsory modules making up 150 Credits in total. A student can select up to two modules in order to make up the remaining 30 credits and to tailor their MSc to their own aspirations and preferences. Students with no anatomy in previous studies are encouraged to take Human Physiology and Anatomy as an option. The availability of these option modules is at the discretion of the University and the list can be modified as demand dictates.

The module 'Engineering for Medical Applications' is a conversion module for students with no background in physical sciences. Students with a demonstrable first degree that contains the subject matter of this module may claim exemption, this should be discussed with the Programme Director on application or on enrolment, but this will need replacing with another option module.

Internship: All students will be encouraged to undertake an internship. The student must indicate their intention to undertake an internship in the first semester of their award; under exceptional circumstances this notification can be made later in the course. For more information: http://www.keele.ac.uk/internships/. Students participating in an appropriate internship would have their experience certified as postgraduate experience to enable them to provide this as evidence for the requirements of professional engineering training. Under the scheme operated by Keele University may be eligible for Institute of Leadership and Management (ILM) accreditation under the Keele University Skills Portfolio (KUSP) scheme.

The project dissertation is a major part of the award. Students are encouraged to select projects that are industry related in order to gain valuable industrial experience. The course team will utilise links with industry and public bodies to endeavour to develop potential project titles. Students should normally achieve a minimum of 120 credits, 60 of which must be the four compulsory Medical Devices Design modules, to be able to progress onto the dissertation module MTE-40015. Successful completion of this module provides the further 60 credits required to be eligible for the award of a Master's degree.

Year	Compulsory	Optional		Electives	
		Min	Max	Min	Max
Level 7	150	30	30	0	0

Module Lists

Level 7

Compulsory modules	Module Code	Credits	Period
Engineering for Medical Applications	MTE-30003	15	Semester 1
Medical Devices Design: Design Control Methodologies	MTE-40045	15	Semester 1
Medical Devices Design: Advanced Materials and Manufacturing	MTE-40047	15	Semester 1
Experimental Research Methodology	MTE-40039	15	Semester 1-3
Medical Devices Design: Regulatory Frameworks	MTE-40049	15	Semester 2
Medical Devices Design: Quality by Design	MTE-40051	15	Semester 2
Project - medical technology	MTE-40015	60	Semester 3

Optional modules	Module Code	Credits	Period
Clean and Green Technologies	ESC-40097	30	Semester 1
Human Physiology and Anatomy	MTE-30001	15	Semester 1
Biomechanics (15 credit module)	MTE-40023	15	Semester 1
Human Physiology and Anatomy	MTE-40024	15	Semester 1
Physiological Measurements	MTE-40026	15	Semester 1
Case Studies in Sustainability	ESC-40030	15	Semester 2
Green IT	ESC-40047	15	Semester 2
Biomaterials	MTE-40036	15	Semester 2

Students may select an option from the diet of L7 modules from across the university but only with the approval of the Course Director.

Learning Outcomes

The table below sets out what students learn in the programme and the modules in which that learning takes place. Details of how learning outcomes are assessed through these modules can be found in module specifications.

Level 7

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
an understanding of the core engineering principles within the context of engineering design practice	Medical Devices Design: Quality by Design - MTE-40051 Medical Devices Design: Regulatory Frameworks - MTE-40049 Engineering for Medical Applications - MTE-30003 Medical Devices Design: Advanced Materials and Manufacturing - MTE-40047 Medical Devices Design: Design Control Methodologies - MTE-40045
an understanding of design methodologies and quality management issues	Medical Devices Design: Advanced Materials and Manufacturing - MTE-40047 Medical Devices Design: Regulatory Frameworks - MTE-40049
modelling techniques commensurate with the role of a medical device designer	Medical Devices Design: Regulatory Frameworks - MTE-40049 Medical Devices Design: Advanced Materials and Manufacturing - MTE-40047
an understanding of statistics and its role in research methods and design quality	Project - medical technology - MTE-40015 Experimental Research Methodology - MTE-40039 Medical Devices Design: Advanced Materials and Manufacturing - MTE-40047 Medical Devices Design: Regulatory Frameworks - MTE-40049

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
an understanding of the role of the engineer in society	Medical Devices Design: Advanced Materials and Manufacturing - MTE-40047 Medical Devices Design: Design Control Methodologies - MTE-40045 Medical Devices Design: Regulatory Frameworks - MTE-40049 Medical Devices Design: Quality by Design - MTE-40051
knowledge of the generic, contextual principles supporting effective medical device design	Physiological Measurements - MTE-40026 Green IT - ESC-40047 Medical Devices Design: Quality by Design - MTE-40051 Biomechanics (15 credit module) - MTE-40023 Medical Devices Design: Design Control Methodologies - MTE-40045 Case Studies in Sustainability - ESC-40030 Human Physiology and Anatomy - MTE-40024 Biomaterials - MTE-40036 Clean and Green Technologies - ESC-40097 Human Physiology and Anatomy - MTE-30001
knowledge of associated environments and new technologies	Medical Devices Design: Design Control Methodologies - MTE-40045 Biomaterials - MTE-40036 Physiological Measurements - MTE-40026 Human Physiology and Anatomy - MTE-40024 Biomechanics (15 credit module) - MTE-40023 Human Physiology and Anatomy - MTE-30001 Green IT - ESC-40047 Clean and Green Technologies - ESC-40097 Case Studies in Sustainability - ESC-40030 Medical Devices Design: Quality by Design - MTE-40051
a critical awareness of technologies in their chosen pathway will develop towards the point where students will comfortably assist in the process of developing research projects, new devices and new solutions	Project - medical technology - MTE-40015
developed the capacity to transfer scientific knowledge into practical application in medical devices design or their personal career choice	Medical Devices Design: Regulatory Frameworks - MTE-40049 Medical Devices Design: Advanced Materials and Manufacturing - MTE-40047 Project - medical technology - MTE-40015

Subject Specific Skills	
Learning Outcome	**Module in which this is delivered**
an understanding of research process and evidence based practise	Experimental Research Methodology - MTE-40039 Project - medical technology - MTE-40015
a demonstrable ability to challenge, evaluate, modify, and develop the theory and practise surrounding engineering design	Medical Devices Design: Advanced Materials and Manufacturing - MTE-40047 Medical Devices Design: Quality by Design - MTE-40051 Medical Devices Design: Regulatory Frameworks - MTE-40049 Medical Devices Design: Design Control Methodologies - MTE-40045 Project - medical technology - MTE-40015
the ability to synthesize and evaluate information obtained from diverse sources and settings	Medical Devices Design: Regulatory Frameworks - MTE-40049 Project - medical technology - MTE-40015 Medical Devices Design: Design Control Methodologies - MTE-40045 Medical Devices Design: Advanced Materials and Manufacturing - MTE-40047 Medical Devices Design: Quality by Design - MTE-40051
the ability to identify personal and professional requirements in order to support lifelong learning	Medical Devices Design: Design Control Methodologies - MTE-40045 Medical Devices Design: Quality by Design - MTE-40051
the ability to plan and manage projects	Medical Devices Design: Regulatory Frameworks - MTE-40049 Medical Devices Design: Quality by Design - MTE-40051 Medical Devices Design: Advanced Materials and Manufacturing - MTE-40047 Medical Devices Design: Design Control Methodologies - MTE-40045 Experimental Research Methodology - MTE-40039

8. Final and intermediate awards

Master's Degree	180 credits	You will require at least 150 credits at Level 7
Postgraduate Diploma	120 credits	You will require at least 90 credits at Level 7
Postgraduate Certificate	60 credits	You will require at least 40 credits at Level 7

Students unable to attain the minimum of 120 credits may be transferred onto the PG Certificate stream and PG Diploma streams as appropriate. In both cases students will be able to make up any shortfall using the two modules: Independent Study (CLM-40085) and Research Practice (CLM-40064) Modules.

If a student fails the project module they may still be eligible for the award of a PGDip.

9. How is the Programme Assessed?

A variety of assessment methods are used across the programme. These include coursework-based essays, written examinations, reports on laboratory-based practical, essay-based examination, interactive oral presentations, and a dissertation based on the student research project.

Clear marking guidelines accompany each mode of assessment where a mark of 50% or above is required to achieve a pass.

Through adoption of the above assessment methods students are given an opportunity to display achievements spanning knowledge and problem-solving abilities, communication and research skills, development of practical skills, and critical thinking.

Formative assessment occurs in a continuous process driven by lecturer-led sessions, one-on-one mentoring, and lecturer-led discussions accompanying taught materials.

Marks are awarded for summative assessments designed to assess your achievement of learning outcomes. You will also be assessed formatively to enable you to monitor your own progress and to assist staff in identifying and addressing any specific learning needs. Feedback, including guidance on how you can improve the quality of your work, is also provided on all summative assessments within three working weeks of submission, unless there are compelling circumstances that make this impossible, and more informally in the course of tutorial and seminar discussions.

10. Accreditation

This programme does not have accreditation from an external body.

11. University Regulations

The University Regulations form the framework for learning, teaching and assessment and other aspects of the student experience. Further information about the University Regulations can be found at: http://www.keele.ac.uk/student-agreement/

If this programme has any exemptions, variations or additions to the University Regulations these will be detailed in an Annex at the end of this document titled 'Programme-specific regulations'.

12. What are the typical admission requirements for the Programme?

See the relevant course page on the website for the admission requirements relevant to this programme: https://www.keele.ac.uk/study/

Applicants should have, or expect to achieve, a minimum of a lower second-class honours degree in a relevant scientific or technical discipline ('relevant' means any STEM degree or one that contains elements of STEM study and relevance is at the discretion of the Course Director).

In exceptional circumstances students with appropriate professional qualifications and/or work experience may be accepted at the University's discretion.

Students whose first language is not English must hold an acceptable qualification in English to a minimum of IELTS 6.5.

Recognition of Prior Learning (RPL) is considered on a case-by-case basis and those interested should contact the Programme Director. The University's guidelines on this can be found here: https://www.keele.ac.uk/qa/programmesandmodules/recognitionofpriorlearning/

13. How are students supported on the programme?

Support is provided throughout the study period with a broad range of student-centric activities.

Initial support is provided during the Induction Week where orientation, study skills introductions, and welcoming events are held: led by the course and the university. Accompanying these events the course handbook, which students receive on their first day details key course information, module structure, module content, assessment formats, and relevant University regulations.

All students are allocated an Academic Mentor at the beginning of the course. This offers an individual resource for assistance with both academic and personal issues where detrimental impacts on academic outputs can develop. Student-mentor meetings occur twice a semester unless special needs require a greater frequency. More information is available in the University's Academic Mentoring Policy document.

Students for whom English is not their first language are offered language classes, facilities and services by the University's Language Centre. In addition to credit-bearing postgraduate modules on English for academic study, students also have access to one-to-one tutorials for individual help and advice, and to a wealth of resources for self-study and practice. Incoming non-native English speaking students take a diagnostic English language assessment during their first week at Keele, after which personalised recommendations for modules or other forms of support are made.

14. Learning Resources

This course is based within the School of Pharmacy and Bioengineering, primarily based at the Guy Hilton Research Centre (GHRC).

The administration team are based on Keele's main campus within the Hornbeam Building.

Teaching delivery will be held in GHRC, on Keele Campus, the Royal Stoke University Hospital site, at external sites, and on industrial premises.

Students on this award are Keele students and have access to all the facilities that title conveys. In particular students have access to a Computer Room at the GHRC and extensive IT facilities on the main campus; the Health Library on the hospital site, and the University library located on the main campus. The main library, for example, houses study spaces that can be used for group work.

On-line, physical and electronic data sources area available through Keele University Library. In addition, students on this award may use the Health Library cited at the Royal Stoke University Hospital.

15. Other Learning Opportunities

Opportunities exist for research projects to be performed at other institutions either by prior arrangement or through regular offerings such as at the Robert Jones and Agnes Hunt Hospital, Oswestry and the University Hospitals of North Midlands Trust.

Students are encouraged to undertake a modern foreign language to support the CV. These are offered by Keele Languages Centre.

16. Additional Costs

As to be expected there will be additional costs for inter-library loans and potential overdue library fines, print and graduation. We do not anticipate any further costs for this programme.

17. Quality management and enhancement

The quality and standards of learning in this programme are subject to a continuous process of monitoring, review and enhancement.

- The School Education Committee is responsible for reviewing and monitoring quality management and enhancement procedures and activities across the School.
- Individual modules and the programme as a whole are reviewed and enhanced every year in the annual programme review which takes place at the end of the academic year.
- The programmes are run in accordance with the University's Quality Assurance procedures and are subject to periodic reviews under the Revalidation process.

Student evaluation of, and feedback on, the quality of learning on every module takes place every year using a variety of different methods:

- The results of student evaluations of all modules are reported to module leaders and reviewed by the Programme Committee as part of annual programme review.
- Findings related to the programme from the annual Postgraduate Taught Experience Survey (PTES), and from regular surveys of the student experience conducted by the University, are subjected to careful analysis and a planned response at programme and School level.
- Feedback received from representatives of students on the programme is considered and acted on at regular meetings of the Student Staff Voice Committee.

The University appoints senior members of academic staff from other universities to act as external examiners on all programmes. They are responsible for:

- Approving examination questions
- Confirming all marks which contribute to a student's degree
- Reviewing and giving advice on the structure and content of the programme and assessment procedures

Information about current external examiner(s) can be found here:
http://www.keele.ac.uk/qa/externalexaminers/currentexternalexaminers/

18. The principles of programme design

The programme described in this document has been drawn up with reference to, and in accordance with the guidance set out in, the following documents:

a. UK Quality Code for Higher Education, Quality Assurance Agency for Higher Education: http://www.qaa.ac.uk/quality-code
b. Keele University Regulations and Guidance for Students and Staff: http://www.keele.ac.uk/regulations

The MSc in Medical Engineering Design has been developed to meet the aspiration of the Higher Education Funding Council for England to increase the number of students exiting with an engineering qualification, but not necessarily having a first degree in engineering.

It has also been developed with an aspiration for it to meet the requirements (subject to accreditation by a Professional Engineering body) of the Engineering Council UK-Spec as a "matching section" towards professional engineering qualifications for those with an accredited first degree in engineering.
http://www.engc.org.uk/UKSPEC

The following documents, guidelines and information sources have been used in the design process.

- Transition to engineering. Engineering council. http://www.hefce.ac.uk/pubs/rereports/Year/2015/Engineering/Title,105476,en.html
- Keele Careers and Employability service Internships. https://www.keele.ac.uk/careers/internships/

19. Annex - Programme-specific regulations

Programme Regulations: Biomedical Engineering

Final Award and Award Titles	MSc Medical Engineering Design
Intermediate Award(s)	Postgraduate Diploma Postgraduate Certificate
Last modified	June 2023
Programme Specification	https://www.keele.ac.uk/qa/programmespecifications

The University's Academic Regulations which can be found on the Keele University website (https://www.keele.ac.uk/regulations/)[1] apply to and regulate the programme, other than in instances where the specific programme regulations listed below over-ride them. These programme regulations list:

- *Exemptions* which are characterised by the omission of the relevant regulation.
- *Variations* which are characterised by the replacement of part of the regulation with alternative wording.
- *Additional Requirements* which set out what additional rules that apply to students in relation to this programme.

The following **exemptions, variations** and **additional requirements** to the University regulations have been checked by Academic Services and have been approved by the Faculty Education Committee.

A) EXEMPTIONS

The clause(s) listed below describe where an exemption from the University's Academic Regulations exists:

For the whole duration of their studies, students on this Programme are exempt from the following regulations:

- **No exemptions apply.**

B) VARIATIONS

The clause(s) listed below describe where a variation from the University's Academic Regulations exists:

Variation 1: module compensation

This programme varies from Regulation D5.4.

A variation of Regulation D5.4 Module Compensation on Taught Postgraduate Programmes and Regulation C7.11.4 will be run on these courses, in which compensation will be applied to modules, which, after all assessment attempts have been taken, have a mark above 45% (i.e. not limited to 45-49%).

On IPEM accredited courses, this will apply to a maximum of 20 credits, provided that a mark of at least 55% in one or more modules at least equivalent to the credit value of the failed module/s being compensated, is attained. Dissertation modules or equivalent final project modules cannot be compensated.

The intention of the variation is to enable students who have not reached the pass mark in all qualifying components, thereby resulting in a Qualified Fail, to be compensated in the above scenario.

As such, in accordance with Regulation D1.12 Reassessment, where a student achieves a fail a Qualifying Component, hence resulting in a Qualified Fail for a module, the student will be allowed reassessment procedures as defined in the regulations.

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[1] References to University Regulations in this document apply to the content of the University's Regulatory Framework as set out on the University website here https://www.keele.ac.uk/regulations/.

Version History

This document

Date Approved: 27 June 2023

Previous documents

Version No	Year	Owner	Date Approved	Summary of and rationale for changes
1	2022/23	AASTHA MONGA	22 August 2022	