A meeting of the Taught Programmes Board will be held on Wednesday 12 July 2023 at 2:00pm through Microsoft Teams and in Department W, Room 3.05

### Agenda

#### Part 1 – Preliminary Items

<table>
<thead>
<tr>
<th></th>
<th>Paper</th>
<th>Led by</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Welcome and Apologies</td>
<td>N/A</td>
<td>Prof. Tony Michael</td>
</tr>
<tr>
<td>2.</td>
<td>Declaration of Interests</td>
<td>N/A</td>
<td>Prof. Tony Michael</td>
</tr>
<tr>
<td>3.</td>
<td>Minutes of the Previous Meeting (26 April 2023)</td>
<td>TPB2022-061</td>
<td>Prof. Tony Michael</td>
</tr>
<tr>
<td>4.</td>
<td>Matters Arising from the Previous Meeting</td>
<td>TPB2022-062</td>
<td>Prof. Tony Michael</td>
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#### Part 2 – For Approval/Discussion

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<thead>
<tr>
<th></th>
<th>Paper</th>
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<th>Timing</th>
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<tbody>
<tr>
<td>5.</td>
<td>Chair’s actions since the last meeting</td>
<td>TPB2022-063</td>
<td>Prof. Tony Michael</td>
</tr>
</tbody>
</table>

#### Part 3 – Programme Proposals/Amendments

**Faculty of Science and Engineering**

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<thead>
<tr>
<th></th>
<th>Paper</th>
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<th>Timing</th>
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<tbody>
<tr>
<td>6.</td>
<td>Programme Amendments</td>
<td>TPB2022-064</td>
<td>Dr Eranjan Padumadasa</td>
</tr>
<tr>
<td></td>
<td>BSc Digital &amp; Technology Solutions (Software Engineer)</td>
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<td></td>
<td>BSc Digital and Technology solutions (Data Analyst)</td>
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**School of Physical and Chemical Sciences**

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<tr>
<th></th>
<th>Paper</th>
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<th>Timing</th>
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<tbody>
<tr>
<td>7.</td>
<td>MSc Artificial Intelligence for Drug Discovery</td>
<td>TPB2022-065</td>
<td>Dr Arianna Fornili</td>
</tr>
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<td></td>
<td>FT&amp;PT</td>
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<tr>
<td>8.</td>
<td>MSc Artificial Intelligence and Machine Learning in Science</td>
<td>TPB2022-066</td>
<td>Dr Marcella Bona</td>
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<td>FT&amp;PT</td>
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**School of Mathematical Sciences**

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<th>Paper</th>
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<th>Timing</th>
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<tbody>
<tr>
<td>9.</td>
<td>MSc Actuarial Science and Data Analytics</td>
<td>TPB2022-067</td>
<td>Prof. Alex Clark</td>
</tr>
<tr>
<td>10.</td>
<td>MSc Applied Statistics and Data Science</td>
<td>TPB2022-068</td>
<td>Prof. Alex Clark</td>
</tr>
</tbody>
</table>
11. MSc Risk Analytics

Faculty of Science and Engineering – JEI with BUPT (Hainan)

12. Module amendments

Dr Pedro Vergel & Dr Lei Fang

TPB2022-069

12. Module amendments

Dr Jesús Requena Carrión

TPB2022-070

13. Programme Amendments*

Module Proposals*

Module Amendments*

Module Withdrawals*

TPB2022-071

N/A

15:45

14. List of Proposed Programmes for launch in 2023/24 or 2024/25

TPB2022-072

N/A

15:50

Part 4 – Report of Proposals Approved by Schools/Institutes to Note

Part 5 – Other business

15. Any other business

Prof. Tony Michael

15:55

16. Date of next meeting/schedule of meetings for AY 23/24

Prof. Tony Michael

16:00

The next meeting will be held on Wednesday 9th August 2023. The deadline for papers is Wednesday 12th July 2023.

<table>
<thead>
<tr>
<th>TPB Meeting Dates 2022/23</th>
<th>Proposal Submission Deadline to DGLS 20 working days before meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday 9th August 2023</td>
<td>Wednesday 12th July 2023</td>
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</tbody>
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<table>
<thead>
<tr>
<th>TPB Meeting Dates 2023/24</th>
<th>Proposal Submission Deadline to DGLS 20 working days before meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday 13th September 2023</td>
<td>Wednesday 16th August 2023</td>
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<tr>
<td>Wednesday 18th October 2023</td>
<td>Wednesday 20th September 2023</td>
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<tr>
<td>Wednesday 29th November 2023</td>
<td>Wednesday 1st November 2023</td>
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<tr>
<td>Wednesday 17th January 2024</td>
<td>Wednesday 6th December 2023</td>
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<tr>
<td>Wednesday 14th February 2024</td>
<td>Wednesday 17th January 2024</td>
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<tr>
<td>Wednesday 20th March 2024</td>
<td>Wednesday 28th February 2024</td>
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<tr>
<td>Wednesday 24th April 2024</td>
<td>Wednesday 27th March 2024</td>
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<tr>
<td>Wednesday 29th May 2024</td>
<td>Wednesday 1st May 2024</td>
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<tr>
<td>Wednesday 17th July 2024</td>
<td>Wednesday 19th June 2024</td>
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<tr>
<td>Wednesday 7th August 2024</td>
<td>Wednesday 10th July 2024</td>
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</table>

6th December 2023 deadline to propose a PGT programme for September 2024 start and a UG programme for September 2025 start. New programmes may be submitted for consideration by TPB later than this deadline only with the approval of the Vice Principal (Education).

Samantha Webb, DGLS
1. Welcome and Apologies

2022.120 The Chair welcomed all members to the meeting. Apologies for absence had been received from KB, JP, JS, PM, PP and SS.

2. Declaration of Interests

2022.121 The Chair invited members to declare any conflicts of interest. CB NOTED that his wife is an Ofsted Inspector.

3. Minutes of the previous meeting (TPB2022-052)

2022.122 The Board CONFIRMED the minutes of the 22 March 2023 meeting subject to amendments to reflect that Dr Craig Agnor (CA) and Dr John Buchanan (JB) had both been present at the meeting.

4. Matters arising from the Previous Meeting (TPB2022-053)

2022.123 The Board NOTED updates on outstanding actions from the previous meetings.
The Chair **NOTED** that, following circulation of paper, updates had been received in relation to open actions from the previous meeting for the WHRI MSc/PgD/PgC Perioperative Medicine proposal. These updates had been reviewed by the Chair, confirmed that the actions had all been completed and met the conditions set by the Board.

It was **NOTED** that the Chair had **APPROVED** the MSc/PgDip/PgCert Perioperative Medicine, Full Time and Part-Time onsite programmes.

5. Chair’s actions since the last meeting (TPB2022-054)

The Board **RECEIVED** a summary of the actions taken by the Chair since the last meeting. This included:

i. Completion of actions required and approval of the MSc/PgD Forensic Mental Health programme under the new title “Forensic Mental Health: Research and Practice”

ii. A new summer school module from SED - *London History and Culture in Image and Film*.

6. Programme Proposals/Amendments

7. Faculty of Science and Engineering

The Board **RECEIVED** Programme Amendments for the following Degree Apprentice (DA) programmes:

i. BSc Digital and Technology Solutions (Software Engineer)

ii. BSc Digital and Technology Solutions (Data Analyst)

iii. MSc Digital and Technology Solutions Specialist (Data Analytics) (*Paper TPB 2022-055*)

The amendments were required to update the two Level 6 Digital and Technology Solutions (DTS) degree apprenticeships and the Level 7 DTS Specialist degree apprenticeship, so as to differentiate them from those degree programmes not leading to an apprenticeship. This required the recoding of previously shared modules, which were block taught to meet the study requirements of the DA, and reflected changes required by the updated L6 apprenticeship standard.

The following points were **NOTED**:

i. That the Degree Apprenticeship Programme Sub-Board (DAPS) had reviewed and supported the amendments, and that their recommendations were reflected in the paperwork.

ii. Thanks to EP and the team for collating the amendment and their continued understanding and management of the complexities surrounding delivery of degree apprenticeships.

The board **APPROVED** the amendments to the Faculty level DA programmes (without conditions).
8. Institute of Health Science Education

2022.131 The Board RECEIVED a Programme Amendment for the PGCert Clinical Education DA. (TPB 2022-056)

2022.132 The Board NOTED that the amendment was required to

a. address over-assessment of apprentices across the programme;

b. to better prepare apprentices for the externally assessed End Point Assessment (EPA);

c. to ensure continued alignment with the relevant degree apprenticeship standard.

2022.133 The Board NOTED the proposal that the single 60 credit module would be taught over one calendar year (August to August) to fit in with clinical rotations within the NHS. The requirement to use non-standard term dates had been approved at the last meeting of Education Quality and Standards Board (EQSB) and were included in the paperwork.

2022.134 The following points were NOTED:

i. That the Degree Apprenticeship sub-Board of TPB had reviewed and supported the amendments, and recommendations were reflected in the paperwork.

ii. That a qualifying mark of 50% was required in each element of assessment in the new module proposal. The proposer confirmed that this was agreed with the employer as a requirement to prepare students for the EPA and that this would be clearly signposted to staff and students when issuing guidance on assessment.

iii. That, given the response of the proposer, the FMD PGT DEB would not support any request to suspend module assessment regulations to remove the qualifying mark.

iv. That the externally assessed EPA had to appear in the diet as a zero-credit module, and that this could be viewed by the regulator as continuation of training beyond the gate to enter EPA.

2022.135 The Board AGREED that DGLS would discuss with Colleagues in Registry Services to consider alternatives to having the EPA as a zero credit placeholder module simply to keep open the student record until such time as the student has completed their EPA.

Action: DGLS

2022.136 The Board APPROVED the amendment to the PGCert Clinical Education (without conditions).

9. History

2022.137 The Board RECEIVED Programme Amendments for all UG provision in the School of History (TPB 2022-057).

2022.138 In seeking to introduce programme-level assessment (PLA) across undergraduate degree programmes, the School required wholesale amendments to all undergraduate diets, both for single and joint honours degree programmes. This approach would enable the School to spread assessment across the academic year, ensuring students received appropriate feedback prior to the submission of their next assessment. Introducing PLA modules would enable the School to test programme level learning outcomes effectively at the appropriate level whilst also ensuring students acquire subject specific skills.
The Board NOTED that:

i. The proposed approach to programme level assessment had been endorsed by the EQSB Assessment Sub-Board in November 2022, and a separate paper (authored by the University Secretary / Chief Governance Officer) on a programme-level approach to assessment had been considered at the December meeting of the Senate.

ii. The School had scheduled workshops for all colleagues to prepare them for the new approach and part of the discussion would be around assessment design in light of generative AI such as ChatGPT to set assessment which reflects both the teaching and resources used by module organisers.

iii. The repetition of Learning Outcomes across the programme was deliberate as the assessment modules were designed to relate to individual student module choices and give students the opportunity to undertake further research in areas which interested them.

iv. The Faculty of Science and Engineering were also in discussion with colleagues about programme level assessment and the approach proposed by the School of History would help inform these discussions.

v. Institution wide approaches and frameworks would be established as more Schools/Institutes discussed assessment design and programme level learning outcomes.

vi. The School, especially Dr Dan Peart, should be COMMENDED for the work involved in formulating programme level learning outcomes and submitting the amendments paperwork.

The Board APPROVED the amendment to UG History provision. In approving the programme amendments, it was NOTED that the Board had only had sight of the module amendments / proposals for Level 4 / Year 1 modules and that module amendments / proposals for Years 2 and 3 would need to be submitted for the Board to see how programme level assessment worked across the entirety of the degree programmes.

10. William Harvey Research Institute

The Board RECEIVED the programme proposal for the MSc/PgD/PgC Perioperative Medicine, by distance learning. (TPB 2022-058)

The proposal was to introduce a new programme as part of the Institute’s critical care provision for healthcare professionals wishing to enhance their understanding of patient care. Programme content had been designed in response to recent reports from the Department of Health and Chief Medical Officer which called for improvement patient care.

The Board NOTED that:

i. DL students did not need to attend/arrange any onsite observations and that a theoretical module on Applied Perioperative Medicine replaced the onsite Observership module.
ii. Once again, a module was to be taught in the non-teaching 3rd semester. MSc students would therefore be taking on new content whilst undertaking their independent research. The proposer confirmed marks would be reviewed at the June SEB for resits to be taken in the late summer.

2022.144 The Board APPROVED the programme proposal for MSc/PgD/PgC Perioperative Medicine to be delivered from 2023/24.

11. Report of Proposals Approved by Schools/Institutes to Note (TPB2022-59)

2022.145 The Board RECEIVED a report of the decisions made by Schools/Institutes for changes to the curricula for the period 23 February – 27 March 2023.

2022.146 The Board NOTED Programme Amendments, Module Proposals, Module Amendments and Module Withdrawals by Schools / Institutes / Faculties.

12. List of Proposed Programmes for launch in 2023/24 or 2024/25(TPB2022-060)

2022.147 The Board RECEIVED a report of programme proposals intended for launch in 2024/25, which were expected to be presented at future meetings.

13. Any other business

2022.148 The Chair REPORTED that a member of the Board had expressed concern over the manner in which Board papers are circulated and considered. Acknowledging that the papers for the April TPB meeting ran to 473 pages, it was NOTED that there is insufficient time for Board members to review all papers ahead of the Board meeting at which comments are invited and decisions are required.

2022.149 It was PROPOSED that, in the event of excessive papers, individual members might be assigned specific items to review and comment on in preparation for the Board.

2022.150 In considering this proposal, it was NOTED that:

   i. While this was a pragmatic proposal that may be necessary given the number of proposals for new programmes and/or programme amendments being submitted to the Board, it did not address the root cause i.e. that so many new programme proposals and significant programme amendments are being brought forward each year.

   ii. Only significant programme amendments are reported to TPB i.e. there will be many more programme amendments considered and approved with School Education Committees (SEC’s) on the delegated authority of TPB.

   iii. Collaborative and high risk programme amendments required review by the Board, and that these would be unavoidably detailed.

   iv. Members would still be encouraged to review all TPB papers, even when allocated specific items for close scrutiny, since final approval, including imposition of conditions, relies on collective decision making to which all Board members contribute.
The Board AGREED that, where board papers were large, items would be assigned to specific members of the Board for detailed scrutiny. This approach would remain in place for the remainder of the calendar year (2023) and the Chair would discuss with DGLS ways to allocate items for detailed consideration.

**Action: Chair & DGLS**

The Board AGREED that the Chair would raise concerns through EQSB regarding the volume of new programme proposals and programme amendments being submitted to TPB.

**Action: Chair**

### 14. Date of Next and Future Meetings

The next meeting will be held on **Wednesday 31st May 2023** (with a paper deadline of Wednesday 3rd May).

<table>
<thead>
<tr>
<th>TPB Meeting Date</th>
<th>Intended Paper Circulation Date (to TPB members)</th>
<th>Paper Submission Deadline (to DGLS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wednesday 31 May 2023</td>
<td>Monday 22 May 2023</td>
<td>Wednesday 3 May 2023</td>
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<tr>
<td>Wednesday 12 July 2023</td>
<td>Monday 3 July 2023</td>
<td>Wednesday 14 June 2023</td>
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<tr>
<td>Wednesday 09 August 2023</td>
<td>Monday 31 July 2023</td>
<td>Wednesday 12 July 2023</td>
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### Actions

<table>
<thead>
<tr>
<th>Minute</th>
<th>ACTION</th>
<th>Responsible</th>
<th>Deadline</th>
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<tbody>
<tr>
<td>2022.135</td>
<td>DGLS to discuss with Colleagues in Registry Services to consider alternatives to having the EPA as a zero credit placeholder module simply to keep open the student record until such time as the student has completed their EPA.</td>
<td>DGLS</td>
<td>19 May 2023</td>
</tr>
<tr>
<td>2022.151</td>
<td>Chair to discuss with DGLS ways to allocate items for detailed consideration.</td>
<td>Chair &amp; DGLS</td>
<td>19 May 2023</td>
</tr>
<tr>
<td>2022.152</td>
<td>Chair to raise concerns through EQSB regarding the volume of new programme proposals and programme amendments being submitted to TPB.</td>
<td>Chair</td>
<td>24 May 2023</td>
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S Webb  
Academic Standards and Quality Officer  
arcs-quality@qmul.ac.uk  
26 April 2023
<table>
<thead>
<tr>
<th>Date</th>
<th>Minute</th>
<th>Programme Details</th>
<th>Action</th>
<th>Progress / Comments</th>
<th>Responsible School / Institute</th>
<th>Programme Organiser</th>
<th>Chair’s / Secretary’s notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>26th April 2023</td>
<td>2022.130.iv</td>
<td>PgCert Clinical Education (DA)</td>
<td>DGLS to review potential alternatives to zero credit placeholder modules to denote the externally assessed EPA</td>
<td>Complete</td>
<td>DGLS</td>
<td>Dr Erik Blair</td>
<td>No immediate resolution to the placeholder. Replacement PIT code would not capture the P/F of the EPA.</td>
</tr>
<tr>
<td>26th April 2023</td>
<td>2022.141</td>
<td>AOB - consideration of paperwork</td>
<td>To determine a process of allocation of proposals / amendments for exceptionally busy meetings.</td>
<td>Ongoing</td>
<td>Chair/DGLS</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>26th April 2023</td>
<td>2022.142</td>
<td>AOB - consideration of paperwork</td>
<td>Dep VP Education to bring programme proposals and the workload of TPB to the attention of ESSG</td>
<td>Complete</td>
<td>Chair</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>22nd March 2023</td>
<td>2022.105.i</td>
<td>MSc Marketing in the Creative Industries</td>
<td>Add that equivalent entry requirements are accepted on the PS.</td>
<td>Complete</td>
<td>School of Business and Management</td>
<td>Dr Zafeirenia Brokalaki / Professor Yasmin Ibrahim</td>
<td>-</td>
</tr>
<tr>
<td>22nd March 2023</td>
<td>2022.108.ii</td>
<td>BSc Management for Social Change</td>
<td>Ensure that the programmes is referred to consistently throughout the documentation as &quot;BSc&quot;</td>
<td>Ongoing</td>
<td>School of Business and Management</td>
<td>Dr Lisa Robinson</td>
<td>No response received. PD has been on sick leave</td>
</tr>
<tr>
<td>22nd March 2023</td>
<td>2022.108.iii</td>
<td>BSc Management for Social Change</td>
<td>Clarify that the 30-minute presentation is a 10 minute presentation with discussion afterwards.</td>
<td>Ongoing</td>
<td>School of Business and Management</td>
<td>Dr Lisa Robinson</td>
<td>No response received. PD has been on sick leave</td>
</tr>
<tr>
<td>Nature of proposal(s)</td>
<td>Report of Chair’s Action</td>
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<tr>
<td>Outcome requested</td>
<td>Taught Programmes Board (TPB) is asked to note the Chair’s Actions since the last meeting of the Board.</td>
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<thead>
<tr>
<th>Approved proposal</th>
<th>EECS - BUPT (Beijing)</th>
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<tbody>
<tr>
<td></td>
<td>BSc(Eng) Telecommunications Engineering with Management (Wireless)</td>
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<td>BSc (Eng) E-commerce Engineering with Law</td>
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<tr>
<td></td>
<td>BSc(Eng) Internet of Things Engineering</td>
</tr>
<tr>
<td></td>
<td>BSc(Eng) Telecommunications Engineering with Management (Multimedia)</td>
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<td>A Programme amendment was submitted to update the final year diet for those students choosing to come to London in 2023/24.</td>
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<td>This would be the first time BUPT student have been able to travel to Queen Mary since Covid.</td>
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|                    | S&E -BUPT (Hainan)  |
|                    | BSc Information and Computational Science: |
|                    | An updated programme specification submitted to reflect L5 module title change, module to be taught in 2024/25. |

Alice de Havillan, DGLS  
a.l.dehavillan@qmul.ac.uk
<table>
<thead>
<tr>
<th>Nature of proposal(s)</th>
<th>Programme Amendment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owning Schools</td>
<td>Faculty of Science and Engineering: EECS &amp; SPCS</td>
</tr>
<tr>
<td>Title of Proposal(s)</td>
<td>Bachelor of Science Digital and Technology solutions (Data Analyst) and Bachelor of Science Digital and Technology solutions (Software Engineering)</td>
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<td></td>
<td>o 2 x Programme Specifications</td>
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<td></td>
<td>o 2 x Programme Amendment forms</td>
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<tr>
<td>Outcome requested</td>
<td>Taught Programmes Board (TPB) is asked to consider and approve the proposed amendments identified above and detailed in the accompanying documentation. If any conditions of approval or recommendations arise from the Board these should be clearly stipulated and articulated to the proposer.</td>
</tr>
<tr>
<td>Potential issues identified and comments on the proposal(s) from Governance and Legal Services</td>
<td>Background</td>
</tr>
<tr>
<td></td>
<td>The Faculty of Science and Engineering, is required to make further amendments to the curriculum for the Level 6 Degree Apprenticeship programmes in Digital Technology Solutions Professional to bring the programme into alignment with the current Degree Apprenticeship Standard.</td>
</tr>
<tr>
<td></td>
<td>This amendment is to replace a level five module with a level four module to build key skills and behaviours across the years of study. He amendment will also ensure eligibility for re-accreditation by TechSkills, the lead for the trailblazer for the standard.</td>
</tr>
<tr>
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<td>The amendment will apply to new students only joining the programme form 2024.</td>
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<td>Programme Structure:</td>
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<td>The programme remains part-time over four years, with students taking 90 credits in each year of study alongside theoretical training supplied by the employer.</td>
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<td>Modules undertaken in year 1 are level 4 introductory modules, they are designed to enable the apprentice to meet the broader KSBs noted in common core and specialism standards.</td>
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<tr>
<td></td>
<td>Further revision will be required to update the final years of the programme (years three and four) to embed reflective practice and maintain KSBs across an apprenticeship.</td>
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</tbody>
</table>
**External Expertise:**
The amendment is the outcome of discussions with Employers and the programme team and will continued to be reviewed as part of the Tech Industry Gold Accreditation process in August 2023.

**Issues:**
None

_Samantha Webb, DGLS_
 s.webb@qmul.ac.uk
Degree Apprenticeships Teaching Programme Board 21/06/23. Summary of the changes to the BSc Digital and Technology Solutions Programmes: (Data Analyst) and (Software Engineering).

The Institute of Apprenticeships released an updated DTSP standard earlier this year that needs to be in effect for new students by no later than 01 September 2023. There has been a significant increase in the KSBs to be delivered moving forward and further many are noted as much detailed.

Items to Note

1. Level 4-6 Modules
   a. We have noted previous feedback from this committee around the *top-heavy* nature of our Level 6 Degrees. We are committed to having 105 credits at programme level 4 and programme level 5, with 150 credits at level 6 thereby ensuring the programme is level locked. (current structure is 180 credits at level 6, 90 at levels 4 and 5).

2. No changes are being proposed to Year 1 Modules
   a. As the modules undertake in year 1 are level 4 introductory modules, they are able to meet a number of the broader KSBs noted in common core and specialism standards. We can advise that the majority of changes will be addressed in years 3 and 4 of the programme.

3. Bespoke Modules
   a. Given OFSTED feedback around bespoke delivery, the programme is being looked at more holistically, ensuring modules are amended to meet new KSBS, Employer needs and overall programme standards. As such, employers are being involved in the review process and modules are being considered from outside of the current provisions, including SPCS/EECS and new modules are looking to be created to ensure coverage of all KSBS.

4. Reflective Practice
   a. We are looking to embed 2x 15 credit reflective practice modules as it would help develop reflective learning habits associated with mapping the KSBs across an apprenticeship. This is similar to the approach from the University of Exeter, who have been the first University to reaccredit their Level 6 degrees with TechSkills for delivery in September 2023.
Timelines:

By end of 2023 TPB deadline, we will provide:

1. Updated programme specifications for 23/24 starts and 2024/5 starts with year 1-4 modules confirmed.

2. Programme Amendment forms related to the removal of existing modules in years 3 and 4.

3. Module proposal forms for new modules being delivered in years 2 and 3 of programme.

4. EPA module amendment forms for both 22/23 starts and 23/24 starts.

Eranjan Padumadasa
Programme Amendment Form

This form should be used to submit a proposal to change a programme of study, i.e. a proposal that modifies the arrangements originally approved by Taught Programmes Board. For example:

- changes in core, compulsory or elective modules
- changes to programme diets

Programme titles changes must be proposed using the Programme Title Change Form. Amendments to programme durations or modes of study can not be requested via this form.

Hovering over the blank boxes with your cursor will display further guidance.

Summary Information (as previously approved)

Programme title(s): Bachelor of Science Digital and Technology Solutions (Data Analyst)

Programme and Route code(s): 

<table>
<thead>
<tr>
<th>Award</th>
<th>Mode of study</th>
<th>Programme Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor of Science (BSc)</td>
<td>Part-time</td>
<td>4 academic years</td>
</tr>
</tbody>
</table>

Responsible School / Institute: Other (please specify by typing in box)

Schools / Institutes who are also involved in teaching part of the programme:

- Faculty of Science and Engineering
- School of Electronic Engineering & Computer Science
- School of Physical and Chemical Sciences

Details of any collaborative institution(s) involved in delivering any part of the programme:

1) What are the proposed amendments?

Please clearly and fully outline the proposed amendments to the programme and attach the updated Programme Specification. Further information regarding any module(s) to be added / removed from the programme(s) can be provided in the table below. Alternatively, this information can be presented in text form in the space below, as long as all of the key information in the table is detailed.

| IOT524U Internet Protocols and Applications module removed from the programme specification for the degree |
| Adding a new level 4 module on Reflective Practice for Technology Professionals |
Academic Year of Study   FT - Year 2

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Module Code</th>
<th>Credits</th>
<th>Level</th>
<th>Module Selection Status</th>
<th>Academic Year of Study</th>
<th>Add / Remove Module from Programme</th>
<th>QMUL Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet Protocols and Applications</td>
<td>IOT524U</td>
<td>15</td>
<td>5</td>
<td>Core</td>
<td>2</td>
<td>Remove</td>
<td></td>
</tr>
<tr>
<td>Reflective Practice for Technology Professionals</td>
<td>IOT4XXU</td>
<td>15</td>
<td>4</td>
<td>Core</td>
<td>2</td>
<td>Add</td>
<td></td>
</tr>
</tbody>
</table>

2) Proposed date of introduction:  
Sept 2024

3) Who does the proposed amendment apply to:  
New students only

4) Rationale
Please outline the rationale for the proposed amendment(s), and explain why it is to be applied to the cohort(s) of students listed in section 3.

The changes to the programme are instigated by the updated standard that dictate the knowledge skills and behaviours an apprentice needs to engage in a degree apprenticeship programme. These changes have been suggested based on level 6 degree apprenticeship standard in digital technology solutions professional version 1.2 in consultation with the relevant employers, taking in to consideration the needs of industry and the employer base that support the delivery of the degree apprenticeship programme. The changes proposed ensure that the study programme engages with the Knowledge Skills and Behaviours outlines in the standard to ensure that the scope of the study programme develop occupational competence.

The changes made ensure that the module composition in the programme is equally distributed with level 4, 5, 6 modules as recommended by Degree Apprenticeship Taught Programmes Sub Board.

IOT524U module was removed as it does not address any specific KSBs in the standard while the IOT4XXU module on Reflective Practice for Technology Professional has been included as it would develop key learning skills and behaviours required by the standard.

5) Resource implications of proposed amendment(s)
Are there any resource implications linked to the proposed amendment(s)?

No change to resources
6) Anticipated practical implications of proposed amendment(s)
Please specify how students’ study might be affected. Please give particular consideration to the impacts on part-time students (if applicable), as well students with disabilities and those who are neurodiverse (e.g. have dyslexia, AD(H)D, autism).

No impact is anticipated with the current change as the module is proposed to bring in more alignment with the apprenticeship standard. Reasonable adjustments measures will apply to this module in the same way as others. And the anticipated change would be seen more from a positive light as the students would find the module more accessible as it caters specifically to the professional area addressing the needs of the data industry.

7) External Examiner(s) and student consultation
Have you consulted your External Examiner(s) and / or students about the proposed amendment(s)? If so, please detail their comments.

The programme changes were discussed at an away day for the Faculty Education Committee for Degree Apprenticeships for Science and Engineering which was attended by academics from the subject discipline and employer representatives from industry represented within the degree apprenticeship offer for Digital Technology Solutions Professional Level 6 programme, as they are key stakeholders of a degree apprenticeship programme who dictate the requirements that needs to be addressed in programmes of this nature. This will go through further consultation to ensure that adequate feedback is captured to make further improvements as required by the standard. The process will then lead to a re-accreditation of the degree apprenticeship programme with TechSkills who will then pass it through the employer forum to ensure that the programme address industry needs and requirements of the broader industry.

8) Provision of information to students
Please specify how the affected students will be made aware of the proposed amendment(s).

Students will be given updated handbooks and programme specifications. Course finder to be updated. This will also be included in the induction programme as well as progression inductions.

A revised Programme Specification must accompany the Programme Amendment Form. Programme Amendments that are not accompanied by the necessary documentation will not be accepted by the Academic Secretariat.

> If the programme amendment relates to the addition of previously unapproved modules, have module proposal forms for any new module(s) been submitted? [No]

> Has the Programme Specification been revised to take into account the programme amendment(s)? [Yes]

Approval of Programme Amendment
<table>
<thead>
<tr>
<th>Role</th>
<th>Name</th>
<th>Date Signed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director of Education</td>
<td>Eranjan Padumasada</td>
<td>2023.06.27 16:04:30 +01'00'</td>
</tr>
<tr>
<td>Head(s) of supporting School / Institute</td>
<td></td>
<td></td>
</tr>
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Head(s) of School / Institute

Head(s) of supporting School / Institute
Programme Amendment Form

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Hovering over the blank boxes with your cursor will display further guidance.

Summary Information (as previously approved)

Programme title(s): Bachelor of Science Digital and Technology Solutions (Software Engineer)

Programme and Route code(s): 

<table>
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<tr>
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Responsible School / Institute: Other (please specify by typing in box)

Schools / Institutes who are also involved in teaching part of the programme:

- Faculty of Science and Engineering
- School of Electronic Engineering & Computer Science
- School of Physical and Chemical Sciences

Details of any collaborative institution(s) involved in delivering any part of the programme:

1) What are the proposed amendments?
Please clearly and fully outline the proposed amendments to the programme and attach the updated Programme Specification. Further information regarding any module(s) to be added / removed from the programme(s) can be provided in the table below. Alternatively, this information can be presented in text form in the space below, as long as all of the key information in the table is detailed.

IOT24U Internet Protocols and Applications module removed from the programme specification for the degree. Adding a new level 4 module on Reflective Practice for Technology Professionals
### Academic Year of Study
**FT - Year 2**

<table>
<thead>
<tr>
<th>Module Title</th>
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2) **Proposed date of introduction:**

Sept 2024

3) **Who does the proposed amendment apply to:**

New students only

4) **Rationale**

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| No |

> Has the Programme Specification been revised to take into account the programme amendment(s)?

<p>| Yes |</p>
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<th>Digitally signed by Eranjan Padumasad</th>
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<td></td>
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</tbody>
</table>
Programme Specification (UG)

Awarding body / institution: Queen Mary University of London
Teaching institution: Queen Mary University of London
Name of final award and programme title: BSc Digital & Technology Solutions (Data Analyst)

Name of interim award(s): 
Duration of study / period of registration: 4 years professional pathway PT
QMUL programme code / UCAS code(s): G4DA
QAA Benchmark Group: Computing
FHEQ Level of Award: Level 6
Programme accredited by: TechSkills
Date Programme Specification approved: 

Responsible School / Institute: School of Electronic Engineering & Computer Science

Schools / Institutes which will also be involved in teaching part of the programme:
School of Physics and Astronomy

Collaborative institution(s) / organisation(s) involved in delivering the programme: 

Programme outline

This programme has been developed under the auspices of the government’s degree apprenticeship initiative (see, for example, https://www.gov.uk/government/publications/apprenticeship-standard-digital-technology-solutions-professional). Degree apprenticeships are intended to capitalise on the strengths of both higher education and vocational education. The model is that the degree apprentice is employed in a substantive job role, while also pursuing a degree.

The Digital and Technology Solutions degree apprenticeships are being supported by Tech Partnership (formerly e-Skills UK) under the Tech Industry Gold framework - see https://www.thetechpartnership.com/recruit-and-train/degree-apprenticeships/. All degrees endorsed by Tech Partnership must combine coverage of the following components:
1. Technology
2. Project management
3. Personal and interpersonal skills
4. Business skills

The Tech Industry Gold undergraduate skills requirements curriculum has been designed with input from leading employers to ensure it is relevant to the needs of today’s businesses. Employers involved include Accenture, BT, Capgemini, CA Technologies, Cisco Systems, Enternships, IBM, Logica, Ministry of Justice, and the NHS. Employers already taking on degree apprentices
Programme Title: Bachelor of Science (BSc) Digital & Technology Solutions (Data Analyst) G4DA

include: Accenture, Bright Future, BT, Capgemini, CGI, Ford, Fujitsu, GlaxoSmithKline, HMRC, HP, IBM, Lloyds Banking Group and Thales.

Aims of the programme

The Digital and Technology Solutions degree apprenticeship is centred on a real job within business that extends the learning beyond the classroom and into the workplace. The principal aim is to integrate academic learning at degree level and on-the-job practical training to provide a holistic programme of education and training to meet the skills needs of employers now and into the future.

More specifically, this programme aims to:

* Give the degree apprentices the opportunity to gain experience in the workplace with top employers while earning their degree
* Help the degree apprentices to grow practical technology expertise with project management, interpersonal and business skills
* Help new-start degree apprentices to kick-start their position in the jobs market by earning the relevant experience that leading employers are looking for, meaning that they are fully equipped with the academic knowledge and work experience needed to get ahead when they graduate
* Help degree apprentices who are already employed find new opportunities for career progression
* Widen participation and relieve fees pressure on students
* Offer study opportunities tailored to the jobs market through the roles of Business Analyst, Data Analyst, IT Consultant and Software Engineer.

What will you be expected to achieve?

Through studying this programme, a typical degree apprentice is expected to develop the following core characteristics, identified in the QAA Benchmark Statement for Computing 2007:

* Understanding of computing and information systems, including awareness of underlying concepts, analytical ability and knowledge of related operational issues
* Ability in computational thinking
* A balance of theoretical knowledge and practical competencies, such that practical experience is supported by an understanding of the underlying principles
* Transferable skills developed in the context of computing but applicable in many other contexts

The degree apprentices then supplement these core characteristics with exposure to industry standard, tailored training and larger-scale problem-solving in their employment.

The above characteristics also map to the areas identified in the SEEC Credit Level Descriptors 2010, which are:

* Development of Knowledge and Understanding
* Cognitive/Intellectual skills
* Practical skills
* Key/transferable skills

The educational approach taken in the programme is incremental development through levels 4, 5 and 6 (see the Framework for Higher Education Qualifications in England, Wales and Northern Ireland 2008), culminating in:

* Knowledge at the boundaries of the discipline, including state-of-the-art
* Advanced critical analysis techniques and problem-solving skills
* Ability to evaluate evidence, arguments and assumptions, and reach sound conclusions
* Ability to make decisions in novel, complex and unpredictable circumstances
* Effective communication in a range of situations and with a range of stakeholders
* A strong sense of personal and professional responsibility

The programme has a strong emphasis on graduate attributes, as summarised in the QMUL Statement of Graduate Attributes. In addition, unusually, the degree apprentice has the opportunity to put these attributes into practice in their employment context simultaneously, thereby reinforcing their importance.
Please note that the following information is only applicable to students who commenced their Level 4 studies in 2017/18, or 2018/19

In each year of undergraduate study, students are required to study modules to the value of at least 10 credits, which align to one or more of the following themes:

- networking
- multi- and inter-disciplinarity
- international perspectives
- enterprising perspectives.

These modules will be identified through the Module Directory, and / or by your School or Institute as your studies progress.

<table>
<thead>
<tr>
<th>Academic Content:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1</strong> Understanding of business operations, procedures and culture applicable to a sustainable career as a Digital &amp; Technology Solutions professional</td>
</tr>
<tr>
<td><strong>A2</strong> Critical understanding and analysis of the theoretical, conceptual and practical issues central to the practice of developing, implementing and maintaining technology solutions</td>
</tr>
<tr>
<td><strong>A3</strong> A real workplace learning pedagogy in order to develop the competences required by employers</td>
</tr>
<tr>
<td><strong>A4</strong> Knowledge of project, people and resource management principles and techniques</td>
</tr>
<tr>
<td><strong>A5</strong> This Degree will meet all of the Knowledge associated with Apprenticeship DTSP standard 1.2 listed on this website, set to commence in September 2023. <a href="https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision">https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision</a></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Disciplinary Skills - able to:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B1</strong> Demonstrate competence and independence in technology solutions to form a solid foundation for further development</td>
</tr>
<tr>
<td><strong>B2</strong> Identify, select, apply and evaluate advanced problem-solving and modelling skills appropriate to developing technology solutions for business</td>
</tr>
<tr>
<td><strong>B3</strong> Demonstrate advanced practical skills in the chosen area of IT occupational competence</td>
</tr>
<tr>
<td><strong>B4</strong> Appreciate the challenges associated with industry standard methodologies, processes, techniques and tools associated with the chosen area of IT occupational competence</td>
</tr>
<tr>
<td><strong>B5</strong> This Degree will meet all of the skills associated with Apprenticeship DTSP standard 1.2 listed on this website, set to commence in September 2023. <a href="https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision">https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision</a></td>
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</tbody>
</table>
Programme Title: Bachelor of Science (BSc) Digital & Technology Solutions (Data Analyst) G4DA

Attributes:

<table>
<thead>
<tr>
<th>C1</th>
<th>Able to engage effectively with staff all levels in the organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>Motivated to learn from experience in a technology solutions project oriented environment</td>
</tr>
<tr>
<td>C3</td>
<td>Able to manage own personal and professional development</td>
</tr>
<tr>
<td>C4</td>
<td>Able to display initiative and resilience in the face of new challenges</td>
</tr>
<tr>
<td>C5</td>
<td>This Degree will meet all of the behaviours associated with Apprenticeship DTSP standard 1.2 listed on this website, set to commence in September 2023. <a href="https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision">https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision</a></td>
</tr>
</tbody>
</table>

How will you learn?

The programme contains a mixture of campus-based and work-based modules. Degree apprentices will study their campus-based modules alongside degree apprentices from other employers and students from related campus-based programmes, to ensure that they experience academic life more broadly, and avoid isolation. The teaching and learning strategies are tailored to the learning outcomes of the different modules.

For campus-based modules, strategies include lectures, lab and tutorial sessions, practical and library-based research, presentations and group work. Lectures are used to introduce principles and methods and also to illustrate how they can be applied in practice, e.g. through examples and case studies. Lab and tutorial sessions will allow students to put these theoretical principles and methods into practice. Practical and library-based research will allow them to develop skills in review, investigative methods and critical analysis. Presentations and group work will enhance their team-working and communication skills. Learning materials will be hosted on Queen Mary's tailored virtual learning environment, QMPlus. This will also provide access to announcement and discussion forums used for asynchronous support. The overall profile of teaching and learning strategies is designed to foster the development of (i) Graduate Attributes, as captured in Queen Mary's Statement of Graduate Attributes and (ii) key skills, as captured in the Tech Partnership endorsement criteria.

For work-context modules, learning materials comparable to those for the equivalent campus-based module are provided, along with appropriate additional study guidance. Supplementary workshop based or tailored individual support is provided through supervision by the module lecturer. Asynchronous and synchronous support may be provided, as appropriate.

The degree apprentices are also assigned an academic adviser / tutor, who is responsible for determining any additional individual / small group academic support needs, in conjunction with the relevant employer(s). Support is tailored and flexible as far as possible, e.g. through measures such as Skype sessions with TAs, “online office hours” for key staff, and employability-linked support to help the degree apprentices understand the links between their study and employment, as well as implications for their personal and professional development.

How will you be assessed?

Campus-based modules are usually assessed through a combination of examination and coursework, as appropriate for the content and focus of each individual module. Laboratory-based modules are often assessed through practical coursework, while more theoretical modules may be assessed through in-class tests, exercise sheets or written assignments.

Assessment for work-context modules is project-based, with QMUL and the employer each contributing 45% to the assessment profile, and the remaining 10% consisting of an oral presentation. QMUL applies standardised project marking criteria, as used in other project-based modules in the School. The employer evaluates the degree apprentice's performance against objectives that are agreed with the degree apprentice, aligned with module learning outcomes and contextualised in the degree apprentice's specific workplace situation. This process is akin to the tried and tested process used in the School's Industrial Experience Placement projects, and may be moderated by the School as necessary.
In addition to summative assessment, the programme provides regular opportunities for formative feedback, e.g. through the submission of a draft report for project-based modules. The School has a feedback policy, which stipulates standard requirements for acceptable types and timing of feedback. The School also uses the Turnitin plagiarism detection system, and students will have the opportunity to submit some formative assignments to Turnitin for feedback on the correctness and effectiveness of their referencing.

How is the programme structured?

Please specify the structure of the programme diets for all variants of the programme (e.g. full-time, part-time - if applicable). The description should be sufficiently detailed to fully define the structure of the diet.

<table>
<thead>
<tr>
<th>Year 1 Modules</th>
</tr>
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<tbody>
<tr>
<td>Semester 1</td>
</tr>
<tr>
<td>IOT401U Procedural Programming (15 credits)</td>
</tr>
<tr>
<td>IOT419U Information Systems Analysis (15 credits)</td>
</tr>
<tr>
<td>DAT4701 Introduction to Data Programming (15 credits)</td>
</tr>
<tr>
<td>IOT427W Professional Research Practice (work based) (15 credits)</td>
</tr>
<tr>
<td>IOT433W Business Organisation &amp; Decision Making (work based) (30 credits)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2 Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester 3</td>
</tr>
<tr>
<td>IOT519U Database Systems (15 credits) (pre-requisite for ECS650A)</td>
</tr>
<tr>
<td>IOT4XXU Reflective Practice for Technology Professionals (15 Credits) **Paperwork to be submitted by October 2023. **</td>
</tr>
<tr>
<td>DAT5901 Data Analysis and Data Solutions (15 credits)</td>
</tr>
<tr>
<td>DAT5902 Professional Software and Career Practices</td>
</tr>
<tr>
<td>DAT4901 The Data Landscape (work based) (30 credits)</td>
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</tbody>
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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Semester 5</td>
</tr>
<tr>
<td>IOT640U Big Data Processing (15 credits)</td>
</tr>
<tr>
<td>IOT6XXXU Ethics Regulation and Law in Advanced Digital Information Processing and Decision Making (15 credits)</td>
</tr>
<tr>
<td>DAT6328 Statistical Data Analysis (15 credits)</td>
</tr>
<tr>
<td>DAT6330 Machine Learning and Artificial Intelligence (15 credits)</td>
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<td>IOTXXXXW Solutions Development and Quality (work based) (30 credits)</td>
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<table>
<thead>
<tr>
<th>Final Year Module</th>
</tr>
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<tr>
<td>Semester 7</td>
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<tr>
<td>IOT607U Data Mining (15 credits)</td>
</tr>
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<td>IOT650U Semi-Structured Data and Advanced Data Modelling (15 credits) (pre-requisite ECS519A Database Systems)</td>
</tr>
<tr>
<td>IOT655U Security Engineering (15 credits)</td>
</tr>
</tbody>
</table>

Semester 7 and 8

IOT635W Project (work based) (30 credits) (pre-requisite for ECS698A)

Semester 8

IOT698U End Point Assessment Module (30 credits) (pre requisite IOT635W) * UPDATED FROM 15 CREDITS AS PER THE 1.2 FRAMEWORK. CURRENT STRUCTURE LISTS OVER 360 CREDITS HOWEVER WILL BE ADJUSTED BY END OF 2023 FOLLOWING REVIEW OF 3RD AND FINAL YEAR MODULES ABOVE

**PAPERWORK TO BE SUBMITTED BY OCTOBER 2023**
Programme Title: Bachelor of Science (BSc) Digital & Technology Solutions (Data Analyst) G4DA

### Academic Year of Study  FT - Year 1

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Module Code</th>
<th>Credits</th>
<th>Level</th>
<th>Module Selection Status</th>
<th>Academic Year of Study</th>
<th>Semester</th>
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<tr>
<td>Procedural Programming</td>
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<td>Information Systems Analysis</td>
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<td>Introduction to Data Programming</td>
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### Academic Year of Study  FT - Year 2

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<tr>
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<td>Reflective Practice for Technology Professionals</td>
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### Academic Year of Study  FT - Year 3

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Programme Title: Bachelor of Science (BSc) Digital & Technology Solutions (Data Analyst) G4DA

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<tr>
<td>Big Data Processing</td>
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<td>Ethics Regulation and Law in Advanced Digital Information Processing and Decision Making (Level 6 equivalent of ECS7025A)</td>
<td>IOT6XXU</td>
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<td>Machine Learning and Artificial Intelligence</td>
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<td>Solutions Development and Quality</td>
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Academic Year of Study    FT - Year 4

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<td>Semi-Structured Data and Advanced Data Modelling</td>
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<td>End Point Assessment Module</td>
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<td>Core</td>
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<td>Semester 2</td>
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What are the entry requirements?

Further information about the entry requirements for this programme can be found at:
http://www.eecs.qmul.ac.uk/undergraduates/entry-requirements/

How will the quality of the programme be managed and enhanced? How do we listen to and act on your feedback?

EECS has a Teaching and Learning Committee (TLC) structure which enables programmes to be both managed and enhanced. The Structure allows for subject level teaching groups and programme coordinators to regularly evaluate the content and
delivery of each programme. Feedback from module evaluations and SSLC meetings are fed into these groups and this provides an opportunity for student feedback to be incorporated into the programmes.

Additionally, programme coordinators work with the Director of Education to ensure each programme is current and can be delivered effectively.

The Student-Staff Liaison Committee provides a formal means of communication and discussion between the School and its students. The committee consists of student representatives from each cohort, together with appropriate representation from School staff. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Student-Staff Liaison Committees meet four times a year, twice in each teaching semester.

Each semester, students are invited to complete a web-based module questionnaire for each of their taught modules, and the results are fed back through the SSLC meetings. The results are also made available on the student intranet, as are the minutes of the SSLC meetings. Any actions necessary are taken forward by the relevant Senior Tutor, who chairs the SSLC, and general issues are discussed and actioned through the School’s Student Experience Learning Teaching And Assessment (SETLA) Committee.

The School’s Teaching and Learning Committee (TLC) advises the Director of Education on all matters relating to the delivery of taught programmes at school level including monitoring the application of relevant QM policies and reviewing all proposals for module and programme approval and amendment before submission to Taught Programmes Board. Student views are incorporated in this Committee’s work in a number of ways, including through student membership and consideration of student surveys and module questionnaires.

The School participates in the College’s Annual Programme Review process, which supports strategic planning and operational issues for all undergraduate and taught postgraduate programmes. The APR includes consideration of the School’s Taught Programmes Action Plan, which records progress on learning and teaching related actions on a rolling basis. Students’ views are considered in the APR process through analysis of the NSS and module questionnaires, among other data.

What academic support is available?

Personal Tutor
All students are allocated a personal tutor for each academic year. Tutors are members of academic staff who provide advice and support to students. They have two main roles: academic and pastoral. First year students will meet their tutor for a weekly tutorial.

In their academic capacity, tutors advise on, and approve, programmes of study. If a student is considering changing their programme of study, or taking a module that does not appear on your recommended programme, they must discuss this with their tutor. Any other academic-related concerns, e.g., general academic progress, should be discussed with their tutor in the first instance. In EECS, the role of tutor is separate from that of Senior Tutor.

In their pastoral capacity, tutors are the first point of contact in case of personal problems or concerns. Tutors recognise that personal problems can severely affect a student’s academic performance, and they will provide a sympathetic and non-judgmental ear, as well as practical help. They can also direct students to other College support services, where appropriate. Discussions with students will always be treated in confidence. However, in cases where academic performance is affected by personal problems, the School must be officially informed, and tutors can also guide students through the correct procedures for doing this.

Tutors can be asked to provide academic references for students for job and other applications after leaving university, and this is another good reason for building and maintaining a good student/tutor relationship.

Senior Tutor
The School has two Senior Tutors. A Senior Tutor is a member of the academic staff who acts as a further point of reference for problems and decisions faced by students. Like tutors, the Senior Tutor has two main roles: academic and pastoral. Students should usually contact their own tutor first for advice, but a tutor may recommend that a student consult the Senior Tutor for either academic or pastoral reasons. If a student finds difficulty talking to their own tutor, they may consult the Senior Tutor directly. The Senior Tutor also serves as the Chair of the Student-Staff Liaison Committee (SSLC).

Employer Support
All degree apprentices have a line manager / task manager at their employer, who has been involved in the recruitment decision and is also responsible for ensuring that the degree apprentice has sufficient time to attend classes on the required days and to keep up with their studies on a regular basis. The line manager / task manager works with the degree apprentice’s academic...
adviser/tutor at QMUL to ensure that the degree apprentice can see the interaction between their everyday employment and their degree, address any problems that the degree apprentice encounters in their studies, and refer the degree apprentice on to more specialised support if needed. Many larger employers also have a separate mentor system for the employees, through which training and development needs are identified - the mentor is included in the discussion loop between QMUL and employer, as appropriate.

How inclusive is the programme for all students, including those with disabilities?

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:
- Finding out if you have a specific learning difficulty like dyslexia
- Applying for funding through the Disabled Students' Allowance (DSA)
- Arranging DSA assessments of need
- Special arrangements in examinations
- Accessing loaned equipment (e.g. digital recorders)
- Specialist one-to-one "study skills" tuition
- Ensuring access to course materials in alternative formats (e.g. Braille)
- Providing educational support workers (e.g. note-takers, readers, library assistants)
- Mentoring support for students with mental health issues and conditions on the autistic spectrum.

Programme-specific rules and facts

The programme is structured around a "professional pathway" model, in which the degree apprentices take 90 credits per academic year, in order to accommodate their work commitments. In each academic year, students take 60 credits of campus-based modules and 30 credits of work-based modules.

Further information on the Academic Regulations can be found at http://www.arcs.qmul.ac.uk/policy

In addition to this the programme does have special regulations (further details are available in the Academic Regulations):
1. There is a requirement for students to achieve a minimum mark of 30.0 in every module, and to pass the project outright (in addition to the standard award rules) in order to achieve the intended, accredited, award.
2. The exit award and the field of study of the exit award will be dictated by the specific modules passed and failed by a student.

Links with employers, placement opportunities and transferable skills

The framework for this degree apprenticeship has been developed by Tech Partnership as a collaboration between some of the UK's leading companies and universities. It offers the degree apprentices a unique opportunity to contextualise their academic study in their workplace environment.

Transferable skills are developed through a variety of means, including embedding of QM Graduate Attributes in taught modules and the project, together with the opportunity to participate in extra-curricular activities, e.g. the School's EECS++ Society, the School's Annual Programming Competition and external competitions with support from the School.

An Employer Links Management Committee (ELM) oversees the strategic development of the programme and monitors its future progress, with a particular focus on listening to employers' perspectives. ELM also has oversight of other relevant School initiatives, to ensure joined-up thinking and sharing of good practice. ELM includes representatives from EECS and the School of Business and Management, Tech Partnership and employers involved in relevant QMUL initiatives. ELM meets at least annually at QMUL, with necessary communication between meetings being conducted electronically, by email or conference call as appropriate.
<table>
<thead>
<tr>
<th><strong>Programme Specification Approval</strong></th>
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<tbody>
<tr>
<td><strong>Person completing Programme Specification:</strong></td>
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<tr>
<td><strong>Person responsible for management of programme:</strong></td>
</tr>
<tr>
<td><strong>Date Programme Specification produced / amended by School / Institute Learning and Teaching Committee:</strong></td>
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<tr>
<td><strong>Date Programme Specification approved by Taught Programmes Board:</strong></td>
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*Queen Mary*

*University of London*
Programme Specification (UG)

Awarding body / institution: Queen Mary University of London
Teaching institution: Queen Mary University of London
Name of final award and programme title: BSc Digital & Technology Solutions (Software Engineer)
Name of interim award(s): N/A
Duration of study / period of registration: 4 years professional pathway PT
QMUL programme code / UCAS code(s): G4DE
QAA Benchmark Group: Computing
FHEQ Level of Award: Level 6
Programme accredited by: TechSkills
Date Programme Specification approved: 
Responsible School / Institute: School of Electronic Engineering & Computer Science

Schools / Institutes which will also be involved in teaching part of the programme:

Collaborative institution(s) / organisation(s) involved in delivering the programme:

Programme outline

This programme has been developed under the auspices of the government’s degree apprenticeship initiative (see, for example, https://www.gov.uk/government/publications/apprenticeship-standard-digital-technology-solutions-professional). Degree apprenticeships are intended to capitalise on the strengths of both higher education and vocational education. The model is that the degree apprentice is employed in a substantive job role, while also pursuing a degree.

The Digital and Technology Solutions degree apprenticeships are being supported by Tech Partnership (formerly e-Skills UK) under the Tech Industry Gold framework - see https://www.thetechpartnership.com/recruit-and-train/degree-apprenticeships/.
All degrees endorsed by Tech Partnership must combine coverage of the following components:
1. Technology
2. Project management
3. Personal and interpersonal skills
4. Business skills

The Tech Industry Gold undergraduate skills requirements curriculum has been designed with input from leading employers to ensure it is relevant to the needs of today’s businesses. Employers involved include Accenture, BT, Capgemini, CA Technologies, Cisco Systems, Enternships, IBM, Logica, Ministry of Justice, and the NHS. Employers already taking on degree apprentices
Programme Title: Bachelor of Science (BSc Digital & Technology Solutions (Software Engineer) (G4DE)

Aims of the programme

The Digital and Technology Solutions degree apprenticeship is centred on a real job within business that extends the learning beyond the classroom and into the workplace. The principal aim is to integrate academic learning at degree level and on-the-job practical training to provide a holistic programme of education and training to meet the skills needs of employers now and into the future.

More specifically, this programme aims to:
* Give the degree apprentices the opportunity to gain experience in the workplace with top employers while earning their degree
* Help the degree apprentices to grow practical technology expertise with project management, interpersonal and business skills
* Help new-start degree apprentices to kick-start their position in the jobs market by earning the relevant experience that leading employers are looking for, meaning that they are fully equipped with the academic knowledge and work experience needed to get ahead when they graduate
* Help degree apprentices who are already employed find new opportunities for career progression
* Widen participation and relieve fees pressure on students
* Offer study opportunities tailored to the jobs market through the roles of Business Analyst, Data Analyst, IT Consultant and Software Engineer.

What will you be expected to achieve?

Through studying this programme, a typical degree apprentice is expected to develop the following core characteristics, identified in the QAA Benchmark Statement for Computing 2007:
* Understanding of computing and information systems, including awareness of underlying concepts, analytical ability and knowledge of related operational issues
* Ability in computational thinking
* A balance of theoretical knowledge and practical competencies, such that practical experience is supported by an understanding of the underlying principles
* Transferable skills developed in the context of computing but applicable in many other contexts

The degree apprentices then supplement these core characteristics with exposure to industry standard, tailored training and larger-scale problem-solving in their employment.

The above characteristics also map to the areas identified in the SEEC Credit Level Descriptors 2010, which are:
* Development of Knowledge and Understanding
* Cognitive/Intellectual skills
* Practical skills
* Key/Transferable skills

The educational approach taken in the programme is incremental development through levels 4, 5 and 6 (see the Framework for Higher Education Qualifications in England, Wales and Northern Ireland 2008), culminating in:
* Knowledge at the boundaries of the discipline, including state-of-the-art
* Advanced critical analysis techniques and problem-solving skills
* Ability to evaluate evidence, arguments and assumptions, and reach sound conclusions
* Ability to make decisions in novel, complex and unpredictable circumstances
* Effective communication in a range of situations and with a range of stakeholders
* A strong sense of personal and professional responsibility

The programme has a strong emphasis on graduate attributes, as summarised in the QMUL Statement of Graduate Attributes. In addition, unusually, the degree apprentice has the opportunity to put these attributes into practice in their employment context simultaneously, thereby reinforcing their importance.
Please note that the following information is only applicable to students who commenced their Level 4 studies in 2017/18, or 2018/19

In each year of undergraduate study, students are required to study modules to the value of at least 10 credits, which align to one or more of the following themes:

- networking
- multi- and inter-disciplinarity
- international perspectives
- enterprising perspectives.

These modules will be identified through the Module Directory, and / or by your School or Institute as your studies progress.

### Academic Content:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>A1</td>
<td>Understanding of business operations, procedures and culture applicable to a sustainable career as a Digital &amp; Technology Solutions professional</td>
</tr>
<tr>
<td>A2</td>
<td>Critical understanding and analysis of the theoretical, conceptual and practical issues central to the practice of developing, implementing and maintaining technology solutions</td>
</tr>
<tr>
<td>A3</td>
<td>A real workplace learning pedagogy in order to develop the competences required by employers</td>
</tr>
<tr>
<td>A4</td>
<td>Knowledge of project, people and resource management principles and techniques</td>
</tr>
<tr>
<td>A5</td>
<td>This Degree will meet all of the Knowledge associated with Apprenticeship DTSP standard 1.2 listed on this website, set to commence in September 2023. <a href="https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision">https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision</a></td>
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### Disciplinary Skills - able to:

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<tr>
<td>B1</td>
<td>Demonstrate competence and independence in technology solutions to form a solid foundation for further development</td>
</tr>
<tr>
<td>B2</td>
<td>Identify, select, apply and evaluate advanced problem-solving and modelling skills appropriate to developing technology solutions for business</td>
</tr>
<tr>
<td>B3</td>
<td>Demonstrate advanced practical skills in the chosen area of IT occupational competence</td>
</tr>
<tr>
<td>B4</td>
<td>Appreciate the challenges associated with industry standard methodologies, processes, techniques and tools associated with the chosen area of IT occupational competence</td>
</tr>
<tr>
<td>B5</td>
<td>This Degree will meet all of the Skills associated with Apprenticeship DTSP standard 1.2 listed on this website, set to commence in September 2023. <a href="https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision">https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision</a></td>
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</table>
Attributes:

C1 Able to engage effectively with staff at all levels in the organisation

C2 Motivated to learn from experience in a technology solutions project-oriented environment

C3 Able to manage own personal and professional development

C4 Able to display initiative and resilience in the face of new challenges

C5 This Degree will meet all of the Behaviours associated with Apprenticeship DTSP standard 1.2 listed on this website, set to commence in September 2023. https://www.instituteforapprenticeships.org/apprenticeship-standards/digital-and-technology-solutions-professional-in-revision

How will you learn?

The programme contains a mixture of campus-based and work-based modules. Degree apprentices will study their campus-based modules alongside degree apprentices from other employers and students from related campus-based programmes, to ensure that they experience academic life more broadly, and avoid isolation. The teaching and learning strategies are tailored to the learning outcomes of the different modules.

For campus-based modules, strategies include lectures, lab and tutorial sessions, practical and library-based research, presentations and group work. Lectures are used to introduce principles and methods and also to illustrate how they can be applied in practice, e.g. through examples and case studies. Lab and tutorial sessions will allow students to put these theoretical principles and methods into practice. Practical and library-based research will allow them to develop skills in review, investigative methods and critical analysis. Presentations and group work will enhance their team-working and communication skills. Learning materials will be hosted on Queen Mary's tailored virtual learning environment, QMPlus. This will also provide access to announcement and discussion forums used for asynchronous support. The overall profile of teaching and learning strategies is designed to foster the development of (i) Graduate Attributes, as captured in Queen Mary’s Statement of Graduate Attributes and (ii) key skills, as captured in the Tech Partnership endorsement criteria.

For work-context modules, learning materials comparable to those for the equivalent campus-based module are provided, along with appropriate additional study guidance. Supplementary workshop based or tailored individual support is provided through supervision by the module lecturer. Asynchronous and synchronous support may be provided, as appropriate.

The degree apprentices are also assigned an academic adviser / tutor, who is responsible for determining any additional individual / small group academic support needs, in conjunction with the relevant employer(s). Support is tailored and flexible as far as possible, e.g. through measures such as Skype sessions with TAs, “online office hours” for key staff, and employability-linked support to help the degree apprentices understand the links between their study and employment, as well as implications for their personal and professional development.

How will you be assessed?

Campus-based modules are usually assessed through a combination of examination and coursework, as appropriate for the content and focus of each individual module. Laboratory-based modules are often assessed through practical coursework, while more theoretical modules may be assessed through in-class tests, exercise sheets or written assignments.

Assessment for work-context modules is project-based, with QMUL and the employer each contributing 45% to the assessment profile, and the remaining 10% consisting of an oral presentation. QMUL applies standardised project marking criteria, as used in other project-based modules in the School. The employer evaluates the degree apprentice’s performance against objectives that are agreed with the degree apprentice, aligned with module learning outcomes and contextualised in the degree apprentice’s specific workplace situation. This process is akin to the tried and tested process used in the School’s Industrial Experience Placement projects, and may be moderated by the School as necessary.
In addition to summative assessment, the programme provides regular opportunities for formative feedback, e.g. through the submission of a draft report for project-based modules. The School has a feedback policy, which stipulates standard requirements for acceptable types and timing of feedback. The School also uses the TurnItIn plagiarism detection system, and students will have the opportunity to submit some formative assignments to TurnItIn for feedback on the correctness and effectiveness of their referencing.

How is the programme structured?
Please specify the structure of the programme diets for all variants of the programme (e.g. full-time, part-time - if applicable). The description should be sufficiently detailed to fully define the structure of the diet.

Year 1 Modules
Semester 1
IOT401U Procedural Programming (15 credits)
IOT419U Information Systems Analysis (15 credits)
IOT427W Professional and Research Practice (worked based) (15 credits)

Semester 2
IOT430U Computer Systems and Networks (15 credits)
IOT414U Object Oriented Programming (15 credits) (pre requisite for IOT639U)
IOT432W Organisation Environment and Decision Making (work based) (15 credits)

Year 2 Modules
Semester 3
IOT505W Software Engineering (work based) (15 credits)
IOT519U Database Systems (15 credits) (pre requisite for IOT650U)
IOT4XXXU Reflective Practice for Technology Professionals (15 Credits) -** Paperwork to be submitted by October 2023. **

Semester 4
IOT506W Software Engineering Project (work based) (15 credits)
IOT518U Operating Systems (15 credits)
IOT529U Algorithms and Data Structures (15 credits)

Year 3 Modules
* UPDATED PROGRAMME SPECIFICATION INCLUDING YEAR 3 AND 4 PAPERWORK TO BE SUBMITTED BY OCTOBER 2023.*
Semester 5
IOT640U Big Data Processing (15 credits)
IOT6XXXA Ethics Regulation and Law in Advanced Digital Information Processing and Decision Making (15 credits)
IOT646W Software Development and Quality (work based) (15 credits)

Semester 6
IOT522W Graphical User Interfaces (work based) (15 credits)
IOT6XXXA Artificial Intelligence (15 credits)
IOT647U Bayesian Decision and Risk Analysis (15 credits)

Final Year Module
Semester 7
IOT655U Security Engineering (15 credits)
IOT650U Semi-Structured Data and Advanced Data Modelling (15 credits) (pre requisite IOT519U Database Systems)

Semester 8
IOT639U Web Programming (15 credits) (pre requisite IOT414U Object Oriented Programming)

Semester 7 and 8
IOT635W Project (work based) (30 credits) (pre requisite for IOT698U)
IOT698U End Point Assessment Module (30 credits) (pre requisite IOT635W) * UPDATED FROM 15 CREDITS AS PER THE 1.2 STANDARD. NOTED THAT THIS CURRENTLYLists OVER 360 CREDITS HOWEVER CHANGES TO YEARS 3 AND 4 WILL REDUCE TO
Programme Title: Bachelor of Science (BSc Digital & Technology Solutions (Software Engineer) (G4DE)

**THE REQUIRED AMOUNT.**

**PAPERWORK TO BE SUBMITTED BY OCTOBER 2023**

### Academic Year of Study  FT - Year 1

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<td>Procedural Programming</td>
<td>IOT401U</td>
<td>15</td>
<td>4</td>
<td>Core</td>
<td>1</td>
<td>Semester 1</td>
</tr>
<tr>
<td>Information Systems Analysis</td>
<td>IOT419U</td>
<td>15</td>
<td>4</td>
<td>Core</td>
<td>1</td>
<td>Semester 1</td>
</tr>
<tr>
<td>Professional Research Practice</td>
<td>IOT427W</td>
<td>15</td>
<td>4</td>
<td>Core</td>
<td>1</td>
<td>Semester 1</td>
</tr>
<tr>
<td>Object Oriented Programming</td>
<td>IOT414U</td>
<td>15</td>
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</tr>
<tr>
<td>Computer Systems and Networks</td>
<td>IOT430U</td>
<td>15</td>
<td>4</td>
<td>Core</td>
<td>1</td>
<td>Semester 2</td>
</tr>
<tr>
<td>Organisation Environment &amp; Decision Making (Work Based)</td>
<td>IOT432W</td>
<td>15</td>
<td>4</td>
<td>Core</td>
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<td>Semester 2</td>
</tr>
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</table>

### Academic Year of Study  FT - Year 2

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Module Code</th>
<th>Credits</th>
<th>Level</th>
<th>Module Selection Status</th>
<th>Academic Year of Study</th>
<th>Semester</th>
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</thead>
<tbody>
<tr>
<td>Database Systems</td>
<td>IOT519U</td>
<td>15</td>
<td>5</td>
<td>Core</td>
<td>2</td>
<td>Semester 1</td>
</tr>
<tr>
<td>Reflective Practice for Technology Professionals</td>
<td>IOT4XXU</td>
<td>15</td>
<td>5</td>
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<td>Semester 1</td>
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<tr>
<td>Software Engineering</td>
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<td>15</td>
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<td>Semester 1</td>
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<td>Operating Systems</td>
<td>IOT518U</td>
<td>15</td>
<td>5</td>
<td>Core</td>
<td>2</td>
<td>Semester 2</td>
</tr>
<tr>
<td>Algorithms and Data Structures</td>
<td>IOT529U</td>
<td>15</td>
<td>5</td>
<td>Core</td>
<td>2</td>
<td>Semester 2</td>
</tr>
<tr>
<td>Software Engineering Project</td>
<td>IOT506W</td>
<td>15</td>
<td>5</td>
<td>Core</td>
<td>2</td>
<td>Semester 2</td>
</tr>
</tbody>
</table>

Queen Mary University of London
Programme Title: Bachelor of Science (BSc Digital & Technology Solutions (Software Engineer) (G4DE)

<table>
<thead>
<tr>
<th>Academic Year of Study</th>
<th>FT - Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module Title</strong></td>
<td><strong>Module Code</strong></td>
</tr>
<tr>
<td>Big Data Processing</td>
<td>IOT640U</td>
</tr>
<tr>
<td>Ethics Regulation and Law in Advanced Digital Information Processing and Decision Making</td>
<td>IOT6XXA</td>
</tr>
<tr>
<td>Software Development and Quality</td>
<td>IOT646W</td>
</tr>
<tr>
<td>Bayesian Decision and Risk Analysis</td>
<td>IOT647U</td>
</tr>
<tr>
<td>Artificial Intelligence</td>
<td>IOT6XXA</td>
</tr>
<tr>
<td>Graphical User Interfaces</td>
<td>IOT522W</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Academic Year of Study</th>
<th>FT - Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module Title</strong></td>
<td><strong>Module Code</strong></td>
</tr>
<tr>
<td>Project</td>
<td>IOT635W</td>
</tr>
<tr>
<td>Semi Structured Data and Advanced Data Modelling</td>
<td>IOT650U</td>
</tr>
<tr>
<td>Security Engineering</td>
<td>IOT655U</td>
</tr>
<tr>
<td>Web Programming</td>
<td>IOT639U</td>
</tr>
<tr>
<td>End Point Assessment Module</td>
<td>IOT698U</td>
</tr>
</tbody>
</table>

What are the entry requirements?

Further information about the entry requirements for this programme can be found at:

http://www.eecs.qmul.ac.uk/undergraduates/entry-requirements/
Programme Title: Bachelor of Science (BSc Digital & Technology Solutions (Software Engineer) (G4DE)

How will the quality of the programme be managed and enhanced? How do we listen to and act on your feedback?

EECS has a Teaching and Learning Committee (TLC) structure which enables programmes to be both managed and enhanced.

The Structure allows for subject level teaching groups and programme coordinators to regularly evaluate the content and delivery of each programme. Feedback from module evaluations and SSLC meetings are fed into these groups and this provides an opportunity for student feedback to be incorporated into the programmes.

Additionally, programme coordinators work with the Director of Education to ensure each programme is current and can be delivered effectively.

The Student-Staff Liaison Committee provides a formal means of communication and discussion between the School and its students. The committee consists of student representatives from each cohort, together with appropriate representation from School staff. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Student-Staff Liaison Committees meet four times a year, twice in each teaching semester.

Each semester, students are invited to complete a web-based module questionnaire for each of their taught modules, and the results are fed back through the SSLC meetings. The results are also made available on the student intranet, as are the minutes of the SSLC meetings. Any actions necessary are taken forward by the relevant Senior Tutor, who chairs the SSLC, and general issues are discussed and actioned through the School’s Student Experience Learning Teaching And Assessment (SETLA) Committee.

The School’s Teaching and Learning Committee (TLC) advises the Director of Education on all matters relating to the delivery of taught programmes at school level including monitoring the application of relevant QM policies and reviewing all proposals for module and programme approval and amendment before submission to Taught Programmes Board. Student views are incorporated in this Committee’s work in a number of ways, including through student membership and consideration of student surveys and module questionnaires.

The School participates in the College’s Annual Programme Review process, which supports strategic planning and operational issues for all undergraduate and taught postgraduate programmes. The APR includes consideration of the School’s Taught Programmes Action Plan, which records progress on learning and teaching related actions on a rolling basis. Students’ views are considered in the APR process through analysis of the NSS and module questionnaires, among other data.

What academic support is available?

Personal Tutor
All students are allocated a personal tutor for each academic year. Tutors are members of academic staff who provide advice and support to students. They have two main roles: academic and pastoral. First year students will meet their tutor for a weekly tutorial.

In their academic capacity, tutors advise on, and approve, programmes of study.

If a student is considering changing their programme of study, or taking a module that does not appear on your recommended programme, they must discuss this with their tutor. Any other academic-related concerns, e.g. general academic progress, should be discussed with their tutor in the first instance. In EECS, the role of tutor is separate from that of Senior Tutor.

In their pastoral capacity, tutors are the first point of contact in case of personal problems or concerns. Tutors recognise that personal problems can severely affect a student’s academic performance, and they will provide a sympathetic and non judgmental ear, as well as practical help. They can also direct students to other College support services, where appropriate. Discussions with students will always be treated in confidence. However, in cases where academic performance is affected by personal problems, the School must be officially informed, and tutors can also guide students through the correct procedures for doing this.

Tutors can be asked to provide academic references for students for job and other applications after leaving university, and this is another good reason for building and maintaining a good student/tutor relationship.

Senior Tutor
The School has two Senior Tutors. A Senior Tutor is a member of the academic staff who acts as a further point of reference for
Programme Title: Bachelor of Science (BSc Digital & Technology Solutions (Software Engineer) (G4DE)

problems and decisions faced by students. Like tutors, the Senior Tutor has two main roles: academic and pastoral. Students
should usually contact their own tutor first for advice, but a tutor may recommend that a student consult the Senior Tutor for
either academic or pastoral reasons. If a student finds difficulty talking to their own tutor, they may consult the Senior Tutor
directly. The Senior Tutor also serves as the Chair of the Student-Staff Liaison Committee (SSLC).

Employer Support
All degree apprentices have a line manager / task manager at their employer, who has been involved in the recruitment decision
and is also responsible for ensuring that the degree apprentice has sufficient time to attend classes on the required days and to
keep up with their studies on a regular basis. The line manager / task manager works with the degree apprentice’s academic
advise / tutor at QMUL to ensure that the degree apprentice can see the interaction between their everyday employment and
their degree, address any problems that the degree apprentice encounters in their studies, and refer the degree apprentice on to
more specialised support if needed. Many larger employers also have a separate mentor system for the employees, through
which training and development needs are identified - the mentor is included in the discussion loop between QMUL and
employer, as appropriate.

How inclusive is the programme for all students, including those with disabilities?

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific
learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate,
postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:
• Finding out if you have a specific learning difficulty like dyslexia
• Applying for funding through the Disabled Students' Allowance (DSA)
• Arranging DSA assessments of need
• Special arrangements in examinations
• Accessing loaned equipment (e.g. digital recorders)
• Specialist one-to-one "study skills" tuition
• Ensuring access to course materials in alternative formats (e.g. Braille)
• Providing educational support workers (e.g. note-takers, readers, library assistants)
• Mentoring support for students with mental health issues and conditions on the autistic spectrum.

Programme-specific rules and facts

The programme is structured around a “professional pathway” model, in which the degree apprentices take 90 credits per
academic year, in order to accommodate their work commitments. In each academic year, students take 60 credits of campus-
based modules and 30 credits of work-based modules.

Further information on the Academic Regulations can be found at http://www.arcs.qmul.ac.uk/policy

In addition to this the programme does have special regulations (further details are available in the Academic Regulations):
1. There is a requirement for students to achieve a minimum mark of 30.0 in every module, and to pass the project outright
(in addition to the standard award rules) in order to achieve the intended, accredited, award.
2. The exit award and the field of study of the exit award will be dictated by the specific modules passed and failed by a
student.

Links with employers, placement opportunities and transferable skills

The framework for this degree apprenticeship has been developed by Tech Partnership as a collaboration between some of the
UK’s leading companies and universities. It offers the degree apprentices a unique opportunity to contextualise their academic
study in their workplace environment.

Transferable skills are developed through a variety of means, including embedding of QM Graduate Attributes in taught modules
and the project, together with the opportunity to participate in extra-curricular activities, e.g. the School's EECS++ Society, the
School's Annual Programming Competition and external competitions with support from the School.
An Employer Links Management Committee (ELM) oversees the strategic development of the programme and monitors its future progress, with a particular focus on listening to employers’ perspectives. ELM also has oversight of other relevant School initiatives, to ensure joined-up thinking and sharing of good practice. ELM includes representatives from EECS and the School of Business and Management, Tech Partnership and employers involved in relevant QMUL initiatives. ELM meets at least annually at QMUL, with necessary communication between meetings being conducted electronically, by email or conference call as appropriate.

Programme Specification Approval

<table>
<thead>
<tr>
<th>Person completing Programme Specification:</th>
<th>Dr Eranjan Udayanga Padumadasa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person responsible for management of programme:</td>
<td>Dr Eranjan Udayanga Padumadasa</td>
</tr>
<tr>
<td>Date Programme Specification produced / amended by School / Institute Learning and Teaching Committee:</td>
<td>14 Jun 2023</td>
</tr>
<tr>
<td>Date Programme Specification approved by Taught Programmes Board:</td>
<td></td>
</tr>
</tbody>
</table>

Queen Mary
University of London
The School wishes to introduce a new programme in the field of AI, calling on expertise across the School and members of FMD. The programme is aligned to the national AI strategy, and aimed at those looking to work in the AI sector or for further study.

The programme will require wholly new modules delivered by the School.

**Programme Structure**

All modules are compulsory/core and there are no electives. FT students take 3 x 15 credits in each teaching semester and a single 30 credit module is taught over the two teaching semesters. The programme concludes with a 60 credit Project, preparation is carried out in Sem 2 but completed over the summer:

**Full time students**

<table>
<thead>
<tr>
<th></th>
<th>Sem 1</th>
<th>Sem 2</th>
<th>Sem 3</th>
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</thead>
<tbody>
<tr>
<td>Three, 15cr modules</td>
<td></td>
<td>Three, 15cr modules</td>
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<tr>
<td>One, 30 credit module</td>
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<td></td>
<td></td>
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<tr>
<td>60 credit Project</td>
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</table>
Part time students: students take 60 taught credits in year one and 60 taught credits in year two alongside the 60 credit project:

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sem 1</td>
<td>Sem 2</td>
</tr>
<tr>
<td></td>
<td>Three, 15cr modules</td>
<td>One, 15cr module</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sem 1</td>
<td>Sem 2</td>
</tr>
<tr>
<td></td>
<td>Two, 15cr modules</td>
<td>One, 30 credit module</td>
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</tbody>
</table>

Entry Requirements
Standard entry requirements of a 2.1 in a related field. The School reserves the right to consider applicants with a good 2.2 in a related field or a 2.1 in a non related field but who have relevant experience/knowledge in the subject area.

Modules
All modules are bespoke to the programme with two including teaching by colleagues in WHRI. The School may open these module to other students in the School, therefore pre-requisites are listed to cater for that possibility.

No module organisers have been assigned to modules: these will be allocated in the March 2024 teaching allocation exercise to include new members of staff yet to be appointed.

Assessment
Modules are assessed using a variety of assessments including of 2 hour, in-class tests, 3 hour face to face exams, lab reports and projects. Group work is also used and the Board should note that SPCS has a clear criteria for awarding individual marks on group assessments which will be tailored to the specific assessments. Word counts are not always possible for assessment based on coding, therefore students are issues with precise guidance and exemplars.

Issues
1) The Board may wish to clarify study load for the Part time diet; 60 taught modules are taken in each year but these are not evenly distributed over the two semesters.
Part 2 Programme Proposal Form

All sections must be completed in full and supplementary information attached where requested. Part 2 proposals should be submitted with the documentation listed below, to the Academic Secretariat who will arrange for the consideration of the proposal at Taught Programmes Board:

- Programme Specification
- External Adviser Feedback Form(s)
- Module Proposal Forms for any new modules forming part of the proposed programme
- Draft Memorandum of Agreement (for any programme proposals involving a collaborative partner)

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

### Summary Information

**Proposed Programme Title:** Artificial Intelligence for Drug Discovery

**Proposed Programme and Route Code(s):** PMSF-QMCHEM1-P5AID14F1 & PMSP-QMCHEM1-P5AID14F2

<table>
<thead>
<tr>
<th>Award</th>
<th>Mode of study</th>
<th>Programme Duration</th>
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</thead>
<tbody>
<tr>
<td>Master of Science (MSc)</td>
<td>Full-time</td>
<td>1 academic year</td>
</tr>
<tr>
<td>Master of Science (MSc)</td>
<td>Part-time</td>
<td>2 academic years</td>
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</table>

**Proposed start date:** September 2024

**Proposed term dates:** standard

Does this programme contain a foundation year or any pre-sessional activity? **No**

Will this programme be available to Science & Engineering Foundation (SEFP) students after completion of the foundation year? **N/A**
1) Programme Management

Please describe the arrangements for the operational management of the programme and the quality assurance and enhancement mechanisms that will be put in place. Consideration should be given to student representatives and hearing student views.

Please complete either section a) for programmes delivered by one QMUL School / Institute or section b) for programmes delivered by more than one QMUL School / Institute. Programme management arrangements for collaborative programmes should also be reflected in the Memorandum of Agreement with the partner institution.

a) Single School / Institute Delivery

This programme will be managed by the School of Physical and Chemical sciences (SPCS). SPCS will take responsibility for the recruiting, admissions and induction of students to the programme. The programme director will be a member of SPCS and report to the SPCS Director of Education (DoE). The Programme Director will attend the SPCS School Education Committee (SEC) who oversee all aspects of Education in SPCS including quality assurance. All advisors and project supervisors will be from SPCS. Progression will be overseen by the Chemistry PGT School Exam Board.

The SPCS student support officer, Senior Tutor and Advisors will provide pastoral support and (academic) advice to all students on the programme. To address student feedback, a student representative from the programme will be invited to join the staff-student liaison committee which meets on a regular basis to address student feedback. SPCS also has a new student feedback process which launches in 2023/24. This involves a google form which student reps can complete with concerns and feedback in advance of the SSLC. These are discussed with colleagues from the Professional Services side of the Education Leadership team before being discussed with the relevant DTL or DoE. Appropriate actions will be taken to address any concerns raised.

Each individual module including the project modules, will be evaluated following the existing procedures in SPCS. These module evaluations will be an opportunity for students to give anonymous feedback on the modules, with numerical results indicating satisfaction and free-text fields to raise any necessary concerns.

An Annual Programme Review (APR) will take place, allowing the programme lead the opportunity to evaluate and reflect on the achievements of the programme, and in particular to document the steps taken to address both student and employer feedback.

b) Joint School / Institute Delivery

For programmes that are delivered jointly between more than one QMUL School / Institute or for programmes that utilise modules from other QMUL Schools / Institutes in an interdisciplinary capacity, a separate joint working statement signed by all relevant Heads of Schools / Institutes should also be provided. This should identify the respective responsibilities of each QMUL School / Institute with regards to programme management, quality assurance, enhancement, and student support, and should be reviewed on an annual basis.
2) Accessibility and inclusivity
Please describe how you have factored in the needs of all students for this programme, including those with disabilities and those who are neurodiverse (e.g. have dyslexia, AD(H)D, autism). Considerations of this nature should include the following:
- Are the learning outcomes for the programme and each module clear?
- Have all reading lists been reviewed in the last academic year with consideration given to texts that are available electronically as well as in hard copy?
- Have all reading lists been included on the Reading Lists Online resource available from Library Services?
- How much of the teaching will be made available via Q-Review and when will recordings be released to students?
- Has consideration been given to using QMPlus to post audio content for students to relisten to?
- Has QMPlus content been checked for accessibility standards with the E-Learning Unit?

Further information and guidance on inclusive practice can be found on the Disability and Dyslexia Service's website.

The following steps will be taken to ensure access in classroom-based modules to ensure accessibility:

* All QMPlus modules will meet the baseline standard defined in the School, following the checklist for accessibility
* Written notes, handouts and any other asynchronous material provided at least 1 week in advance where appropriate, and in different readable formats upon request.
* Videos will have closed captions provided
* All images will have ALT text provided
* Microphones will be used in classrooms
* Active learning: the primary delivery mode for teaching will be "flipped classroom", with asynchronous tasks on QMPlus followed by interactive sessions that build on the understanding from those tasks.
* Use of QReview and other mixed media (e.g. Zoom) in order to provide recordings of sessions.
* Hard copies of all relevant books to be made available in the library, or printed copies of electronic resources provided upon request, for those that cannot read from a computer screen.
* Detailed advice from the SPCS Student Support Officer for affected students, including liaising with the QMUL disability service.
* Extra time provided in assessments where required
* Teaching sessions will have a 10 minute break after each 50 minute period.
* Learning outcomes will be made objective and accessible for each module, and connect directly to the Skills, Knowledge, and competencies defined in the chemistry benchmark.

In addition, reasonable adjustments will be made to the computer-based aspects of the module, for example in enabling accessible technologies, additional teaching support, and/or extra time for students with visual or motor impairments that impact routine computer use.

3) Plagiarism Detection
Consideration should be given to the use of plagiarism detection software e.g. turnitin, for programmes with a significant proportion of written assessed work. Please provide information about how this will be managed for the programme.

Standard plagiarism detection will be used, with assessed work checked by Turnitin after submission on QMPlus. SPCS has a dedicated Lead for Assessment offenses and a school policy for investigating offenses for coursework (CW) counting for 30% or less of the module mark. For CW>31%, these will be referred to the Appeals, Complaints and Conduct Office (ACCO).

4) Academic Staffing for the programme (non-QMUL staff)
Please list any academic staff that are not employed or managed by QMUL that will be involved in the teaching or assessment of the programme. For collaborative programmes, this list should include staff from the partner institution(s) who will be involved in delivering the proposed programme.

N/A
5) Distance Learning Programmes (if applicable)
If the programme is to be delivered via distance learning, please describe the specific arrangements in place to ensure the quality of distance learning provision. Particular consideration should be given to enrolment, assessment, provision of learning materials, and student support. All proposals for new distance learning programmes should be discussed with the e-Learning team.

N/A

6) Subject Examination Board Details
Please specify the name of the Subject Examination Board (SEB), which will oversee the assessment processes that operate for the programme(s) and modules. Clarify whether this is a new or existing SEB. For further information please contact Simon Hayter.

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Physical and Chemical Sciences</td>
<td>Chemistry (PGT)</td>
</tr>
</tbody>
</table>

The following documents must accompany the Part 2 Programme Proposal. Proposals that are not accompanied by the necessary documentation will not be considered by Taught Programmes Board.

- Has a Programme Specification been completed and submitted with the Part 2? Yes
- Have module proposal forms for each new module been submitted with the Part 2? Yes
- Has at least one External Adviser Feedback Form been submitted with the Part 2? Yes
- If any special regulations are required for the proposed programme, have these been clearly documented and/or appended? N/A

Collaborative provision: programmes that are offered in partnership with an external organisation should usually have the following documents appended to the Part 2 Programme Proposal.

- Has a draft Memorandum of Agreement been submitted with the Part 2? N/A

Approval of Part 2 Programme Proposal
The signature of the Heads of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

Once a programme has passed Part 2 approval offers can be made to applicants. For programmes that are offered in partnership with an external organisation, offers cannot be made until the Memorandum of Agreement has been signed. This will be arranged by the Academic Secretariat.
External Adviser Feedback Form

Purpose

External Advisers are usually members of academic staff external to Queen Mary, who are asked to comment on proposals for new undergraduate or postgraduate taught programmes in accordance with the above guidelines.

External Advisers should expect to receive and review:
- Part 2 Programme Proposal Form
- Programme Specification
- Module Proposal Forms for any new modules

Scope

External Advisers are asked to provide feedback on each of the areas listed below, in relation to the proposed programme. Please note that this list is not exhaustive, and Advisers are encouraged to comment on any aspect of the proposal; drawing on their own knowledge and experience. As a guide, an external advisor’s report for a standard undergraduate or taught masters programme would normally be in the region of two to four sides of A4.

External Adviser details

<table>
<thead>
<tr>
<th>Name &amp; Title of External Adviser:</th>
<th>Dr Jiayun Pang</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Post &amp; Institution / Organisation:</td>
<td>Associate Professor in Computational Chemistry, Faculty of Engineering and Science, University of Greenwich</td>
</tr>
<tr>
<td>Email address for correspondence:</td>
<td><a href="mailto:j.pang@gre.ac.uk">j.pang@gre.ac.uk</a></td>
</tr>
<tr>
<td>I confirm that I have received and reviewed the documentation listed above:</td>
<td>☒</td>
</tr>
</tbody>
</table>

1. Aims, objectives and learning outcomes

- Does the programme have clearly articulated aims and learning outcomes which appear to meet the needs of students and equip them for further study or employment?
- Do the academic standards in subject content and teaching and learning match the aims and learning outcomes?
- Are all programme learning outcomes met within modules?
- Are the learning outcomes and the expectations of students clearly developed throughout the programme?

The program has clearly articulated aims and learning outcomes which meets the urgent needs of the industry and research field. I am confident that the program will prepare students with highly sought-after interdisciplinary skills for further study at the PhD level and employment in the relevant industry. This is an extremely timely new program and well done to the program team for designing such an impressive curriculum that clearly identifies the breadth and depth of the relevant knowledge and skills needed. The proposed subject content and teaching and learning activities match the aims and learning outcomes very well. Students will be able to develop a broad range of practical skills and knowledges through the proposed modules.
2.a. Curriculum, design, content and organisation

- Does the design and content of the curricula support student learning, and the achievement of the intended learning outcomes?
- Does the content and design of the curricula aid progression through the programme?
- Is the specialist content of the programme up to date and comparable with that of similar programmes elsewhere?
- Is the structure of the programme clearly defined and explained?
- Is the credit structure appropriate for a programme of the assigned level?
- Is the student workload appropriately balanced across the academic year?
- Does the programme include appropriate careers education?
- Is consideration given to work-based and placement learning?
- Are professional practice requirements noted where relevant?
- Have equal opportunities been considered in the development?

There are a few other similar MSc programs run by other HEIs in the UK, such as MSc digital chemistry at Imperial College and the University of Southampton. However, the proposed MSc program at QMUL is unique as it has a strong focus on the applications of machine learning/deep learning for drug design and discovery.

The curriculum has been designed thoughtfully to support student learning. In term 1, students will be introduced the basics of programming and fundamentals of medicinal chemistry to build up their knowledges and skills to underpin more advanced topics in term 2. It also makes sense to introduce molecular modelling in term 1 as it is a topic that most of the students may have come across as part of their undergraduate study and serves as a good starting point to build up students’ knowledge of In Silico drug discovery. Term 2 covers more advanced topics and practical skills with all modules designed with highly relevant materials and computer lab sessions. Students will be able to develop substantial and specialised expertise in AI- and data-driven drug discovery. The student workload is balanced across the academic year.

I may have missed it (it may well be covered in other modules) but the indicative content of the Module SPC707P does not seem to include some of the state-of-the-art terms and concepts, for example large language models, pre-training and transfer learning. These topics are key for students to understand the current development of AI and can serve as part of the broader introduction to machine learning to broaden students’ horizon. If the expertise is not covered by the usual program teaching team, guest speakers from industry and the computer science department could be considered.

Career education is embedded into the curriculum. For example, in CHE706P, one assessment is the career exploration project which serves for students to understand the skill needs of the industry and how what they are learning is positioned within the R&D pipeline.

Minor comments: Conder renaming CHEM703P Ligand-based approaches to drug discovery with a clearer emphasis on AI/In Silico, perhaps something like “In Silico Ligand-based drug discovery”.

CHEM709P, consider renaming to Introduction to (Scientific) Programming to make it more general, as this is the module to build up students’ basic programming skills, and not necessarily only for drug discovery.

2.b. For collaborative programmes only

- Is there a clear rationale for developing this collaborative arrangement in the proposed way?
- If any academic credit is to be recognised from / by the partner institution, is the credit structure of all awards clear and appropriate?
- Is there an appropriate balance of content between each partner?
- Are the academic and administrative responsibilities of each partner clear and appropriate?

N/A
2. Learning, teaching and assessment strategies
   • Is there a clear and workable learning and teaching strategy?
   • Is there a clear and workable assessment strategy?
   • Do the teaching, learning and assessment methods allow students to demonstrate their achievement of the aims and learning outcomes?
   • Is there an appropriate range of assessment methods used?
   • Do the proposed assessment methods suitably evaluate the attainment of the intended learning outcomes?

All learning, teaching and assessment strategies are workable and clear in the documents which is suitable for evaluating the intended learning outcomes. There is also a variety of assessment formats, ranging from presentation, portfolio to project report and exams, which assess a wide range of knowledge and skills and is appropriate for a program at Level 7.

Considering the high proportion of practical skills in the learning outcomes, the program team may want to look into reducing the weighting of exams from 75% to 50% in some modules. For example, in CHE706P, the group presentation and the career exploration project are both excellent assessment and serve to develop the crucial scientific communication skills and understanding of career pathways. The weighting of the two assessment items could be increased to 25% each and the exam reduce to 50%.

From what I can see in the assessment plan, two pieces of assessment for a 15-credit module and three pieces of assessment for a 30-credit module seem to be common. For CHEM704P, again a very practical skills driven course, I would think the in-class test and group presentation at 50% each would be sufficient to assess learning outcomes. I am not too sure what added value the exam would bring.

3. External reference points
   • Has reference been made to Benchmark Statements where applicable?
   • Has reference been made to Framework for Higher Education Qualifications (FHEQ)?
   • Does every award in the programme meet the expectations of the FHEQ?
   • Has reference been made to any relevant Professional and Statutory Regulatory Bodies (PSRBs)?
   • Has reference been made to the Southern England Consortium for Credit Accumulation and Transfer (SEEC) credit level descriptors?

The program fully meets the expectations of the FHEQ in terms of students' understanding of knowledges and techniques, as well as their ability to critically evaluate and apply their skills and knowledge at the forefront of the discipline.

4. Admission, progression and achievement
   • Are the entry requirements appropriate and clearly identified?
   • Are clear arrangements in place for the induction of new students?
   • Are there details for any special educational needs requirements?

The entry requirements are appropriate and clearly identified. They are in line with common MSc entry requirements at other HEIs in the UK. The induction arrangement is not included separately in the documents, but I can see that each student will be assigned an academic advisor and supported by the dedicated student support officer to help them ease into the program. Special education needs and possible adjustments are clearly listed.

5. Learning resources and facilities
   • Have indicative reading lists been supplied and are they appropriate?
   • Have any future resources requirements been clearly articulated?
   • Has the use of QMPlus (the QM Virtual Learning Environment (VLE)) been clearly articulated?
   • Is there use of distance or blended learning? If so, is this appropriately supported?
   • Are their details of and arrangements with placement providers where relevant?
Indicative reading lists are supplied for all modules and are up to date, which reflects the state-of-the-art in the field. The reading lists only include books. It may be useful to include high quality online content, such as resources from Coursera to help expand students' knowledge and expertise if they wish to. Considering how rapidly the field is developing, I would recommend regular review and update of the reading lists.

The program will be heavily relied on IT support to set up the online platforms/PC labs with appropriate software installed. This has been clearly indicated in the module proposals and will be instrumental for the smooth running of the MSc program.

6. **Student guidance and support**
   - Are there clear arrangements in place for supporting students with specific learning requirements?
   - Are there suitable arrangements for dealing with academic misconduct?
   - Are there workable academic support arrangements at school and institution level?
   - Are there administrative arrangements for student support?

Clear arrangement is in place for supporting students with specific learning requirements. Suitable arrangements for dealing with academic misconduct have been clearly stated. Students on the program will have long screen hours. It is good to see that the program team has also identified reasonable adjustments, such as enabling accessible technologies, additional teaching support, and/or extra time for students with visual or motor impairments that impact routine computer use.

It seems standard academic support will be available at school and institution level. However, the challenges students will face on the proposed MSc will be far greater than a MSc in their usual domain of expertise. I feel additional academic support, such as in programming and maths relating to machine learning/deep learning should be in place to support students with different prior knowledge/academic background to ensure student success.

7. **Quality management and enhancement**
   - Are appropriate arrangements in place for programme management?
   - Are clear quality assurance measures in place?
   - For joint programmes, are the responsibilities of all contributing schools / institutes clearly articulated?
   - Are details of continued currency and viability of the programme included?
   - Are effective mechanisms in place for capturing and utilising the student voice?

Program management and quality assurance measures are well in place with standard university mechanisms to capture student feedback.

Considering how fast the field is developing, the program team could consider setting up an advisory board formed by active practitioners from industry and academia in addition to the appointment of an external examiner. The board will be able to feedback on the relevance of the curriculum to ensure continued currency and viability of the program.

8. **Other**
   - Please use this space to provide any additional feedback not covered in other sections.

There is limited information about the number of staff who will deliver the program and their respective expertise in the paperwork I have received. For such a highly specialised MSc program positioned at the forefront of the research field, additional resources, in particular staff might be needed. This is particularly important when the student intake is large where a suitable number of academic staff will be needed to provide MSc research project supervisor.

The program team may want to explore collaboration with industry using the MSc program. One possibility is to build a Level 7 research scientist apprenticeship. Research scientists in the relevant industry can use the program to upskill in machine learning and work on business-critical projects as their MSc research project.
For QMUL use only

9. Response to External Adviser feedback

- Please include a full response to the comments provided by the External Adviser. Each point / issue raised by the External Adviser that requires further consideration should be addressed in detail in this response.

Section 2.a

I may have missed it (it may well be covered in other modules) but the indicative content of the Module SPC707P does not seem to include some of the state-of-the-art terms and concepts, for example large language models, pre-training and transfer learning. These topics are key for students to understand the current development of AI and can serve as part of the broader introduction to machine learning to broaden students’ horizon.

We agree on the importance of the cited models and we will definitely cover more advanced topics like large language models especially in the final parts of this and other modules (in particular CHE704P). Since the purpose of SPC707P is to provide a general foundation in ML/DL concepts and, as noted by the adviser in other parts of the reports, this is a rapidly changing field, we believe it is better to reserve this level of detail to the syllabus and keep the module specification more general.

Minor comments: Consider renaming CHEM703P Ligand-based approaches to drug discovery with a clearer emphasis on AI/In Silico, perhaps something like “In Silico Ligand-based drug discovery”.

We agree with the advisor, the name has been modified to “Computational ligand-based drug discovery”).

CHEM709P, consider renaming to Introduction to (Scientific) Programming to make it more general, as this is the module to build up students’ basic programming skills, and not necessarily only for drug discovery.

The module does contain components and learning outcomes that are specific to drug discovery, so we have kept the original name.

Section 2.c

Considering the high proportion of practical skills in the learning outcomes, the program team may want to look into reducing the weighting of exams from 75% to 50% in some modules. For example, in CHE706P, the group presentation and the career exploration project are both excellent assessment and serve to develop the crucial scientific communication skills and understanding of career pathways. The weighting of the two assessment items could be increased to 25% each and the exam reduce to 50%.

From what I can see in the assessment plan, two pieces of assessment for a 15-credit module and three pieces of assessment for a 30-credit module seem to be common. For CHEM704P, again a very practical skills driven course, I would think the in-class test and group presentation at 50% each would be sufficient to assess learning outcomes. I am not too sure what added value the exam would bring.

To address this point we have modified the weights of the assessments so that all the examinations are now at 50%. For CHE704P, we believe the examination is still the fairest and most authentic way of assessing the academic content learning outcomes. We have also slightly redistributed the weights for the assessments of the coursework-only modules.
Section 5

Indicative reading lists are supplied for all modules and are up to date, which reflects the state-of-the-art in the field. The reading lists only include books. It may be useful to include high quality online content, such as resources from Coursera to help expand students' knowledge and expertise if they wish to. Considering how rapidly the field is developing, I would recommend regular review and update of the reading lists.

We agree with the advisor that this is a rapidly evolving field and we will definitely update the reading lists every year. In the reading lists that go in the programme specification we normally include only consolidated sources such as books, while links to websites are reserved to our online learning platform and lecture notes, so that they can be more frequently checked and updated.

Section 6

It seems standard academic support will be available at school and institution level. However, the challenges students will face on the proposed MSc will be far greater than a MSc in their usual domain of expertise. I feel additional academic support, such as in programming and maths relating to machine learning/deep learning should be in place to support students with different prior knowledge/academic background to ensure student success.

In the School we have now extensive experience in teaching programming from scratch and CHE709P has been specifically designed to introduce programming to absolute beginners, to take into account the diverse background of the students. Programming support will be provided by lecturers and demonstrators in the extensive lab sessions planned not only for CHE709P but also for CHE703P, CHE704P and SPC707P. SPCS is also currently recruiting a new lecturer in math education to provide additional math support for programmes in the School.

Sections 7/8

Considering how fast the field is developing, the program team could consider setting up an advisory board formed by active practitioners from industry and academia in addition to the appointment of an external examiner. The board will be able to feedback on the relevance of the curriculum to ensure continued currency and viability of the program.

The program team may want to explore collaboration with industry using the MSc program. One possibility is to build a Level 7 research scientist apprenticeship. Research scientists in the relevant industry can use the program to upskill in machine learning and work on business-critical projects as their MSc research project.

At this stage we plan to involve industry mostly through guest lectures and individual research projects through collaborations with industry partners that are already in place in the school. Representatives from industry were consulted when planning this programme and their suggestions were taken into account when developing the curriculum. After the first 1-2 years of the programme we will re-evaluate and see if we need an advisory board in addition to the external examiner and if an apprenticeship programme would be viable.

Section 8

There is limited information about the number of staff who will deliver the program and their respective expertise in the paperwork I have received. For such a highly specialised MSc program positioned at the forefront of the research field, additional resources, in particular staff might be needed. This is particularly important when the student intake is large where a suitable
number of academic staff will be needed to provide MSc research project supervisor.

MOs are not indicated since they will be confirmed when the teaching allocation is carried out in March 2024. Relevant expertise in data science/AI and computational Pharmaceutical Chemistry is covered by members of both departments in SPCS (at least 6/7), while the general drug discovery and Pharmacology components will be covered by colleagues in FMD. Additionally, the department of Chemistry has a number of new staff (up to 6) joining in the next few months, with one specifically appointed to teach on this programme. Some of this teaching will be allocated to them as well as existing members of staff.

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**External reference points**

Programme Title: Artificial Intelligence for Drug Discovery

Programme Specification (PG)

Awarding body / institution: Queen Mary University of London
Teaching institution: Queen Mary University of London
Name of final award and title: Master of Science in Artificial Intelligence for Drug Discovery
Name of interim award(s): PG Cert/PG Dip
Duration of study / period of registration: 12 months (FT), 24 months (PT)
Queen Mary programme code(s): 
QAA Benchmark Group: Chemistry
FHEQ Level of Award: Level 7
Programme accredited by: 
Date Programme Specification approved: 
Responsible School / Institute: School of Physical and Chemical Sciences

Schools / Institutes which will also be involved in teaching part of the programme: 

Collaborative institution(s) / organisation(s) involved in delivering the programme: 

Programme outline

Drug discovery in industry and academia is increasingly reliant on computational methods. Artificial Intelligence (AI) is creating a revolution in the field, thanks to the advancements in computational power and the increased availability both of efficient algorithms and of high-quality data. Machine learning and advanced data analysis techniques are not part of the traditional training in undergraduate Chemistry, Pharmaceutical Chemistry or related degrees. Consequently, there is a shortage of professionals with the breadth of knowledge and skills required to effectively apply computational methods to drug discovery pipelines.

The MSc programme in Artificial Intelligence for Drug Discovery will cover:
- Principles of drug discovery and lead optimisation
- Scientific programming
- Supervised and unsupervised machine learning methods
- Deep learning methods
- Modelling and simulation techniques applied to biomolecular systems

Taught by experts from the School, delivery of the programme will involve a combination of face-to-face teaching and interactive workshops to cover the theoretical aspects of the programme. Students will have the opportunity to develop
practical coding skills and use state-of-the-art software in extensive computer lab sessions. Students will also acquire valuable research experience by carrying out a research-based project where they will apply the concepts and tools learnt in the taught modules to complex problems.

Highlights:
- New programme with a unique and comprehensive combination of topics in Artificial Intelligence for drug discovery
- Emphasis on practical skills
- No previous knowledge of coding or machine learning is assumed

Aims of the programme

The aim of the MSc programme in AI for Drug Discovery is to provide students with the breadth and depth of knowledge required to apply state-of-the-art computational techniques to drug discovery and development pipelines, interpret the resulting predictions and assess their quality. The wide range of competences required for the delivery of the programme will be provided by academic staff in the newly formed School of Physical and Chemical Sciences.

More specifically, the programme aims to:

* Provide students with an in-depth understanding of a range of topics including principles of drug discovery and design, machine learning, deep learning, chemoinformatics, and biomolecular modelling and simulation.
* Develop practical coding skills essential to apply artificial intelligence to the field of drug discovery.
* Enable students to acquire substantial research experience through a final research-based project.

This programme will equip students with the knowledge, skills and competencies to contribute to the future of drug discovery. Specifically, it will generate highly skilled graduates better prepared for a career in research or in the pharmaceutical and other chemical industries.

What will you be expected to achieve?

Students who successfully complete the programme are expected to possess the following knowledge/skills/attributes:

<table>
<thead>
<tr>
<th>Academic Content:</th>
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<td>A1</td>
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<td>A3</td>
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<td>A4</td>
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</table>

Disciplinary Skills - able to:
Programme Title: Artificial Intelligence for Drug Discovery

| B1 | Independently identify, select, combine and use computational tools to solve complex problems in drug discovery |
| B2 | Critically assess and reflect on the performance and reliability of machine learning and molecular modelling methods applied to drug discovery |
| B3 | Write, test and document scientific code to perform a range of tasks in drug discovery, including searching and extracting information from databases, performing predictions, analysing and visualising data, and automating pipelines. |
| B4 | Conduct and report on a significant piece of research work related to the problems and challenges in drug discovery. |

Attributes:

| C1 | Ability to use problem-solving skills and computational tools to solve unfamiliar problems |
| C2 | Ability to communicate complex ideas and concepts in a clear, concise and informative way that is appropriate for the audience |
| C3 | Ability to work with information that may be incomplete or uncertain |
| C4 | Ability to work effectively as part of a team |
| C5 | Ability to manage time, prioritise workload and work to deadlines |

How will you learn?

Acquisition of knowledge and understanding in taught modules will generally be achieved by on campus face-to-face teaching and interactive workshops. These will be complemented and supported by extensive online content (videos, slides, practice questions etc...) that will be made available before each session.

The programme has a strong emphasis on the development of practical skills, including coding, independent use of a range of drug discovery tools and report writing, which will be achieved through extensive computer lab sessions. Individual support will be provided during these sessions by academic and research staff to reinforce theory and concepts covered in face-to-face teaching sessions.

The ability to design pipelines, independently evaluate and compare method performance will be also developed through coursework based on the critical assessment of case studies. The project module will give the students the opportunity to develop research, communication and reporting skills through weekly support provided by the supervisory team. Additional taught sessions in this module will provide support for the development of writing and oral communication skills, and for the understanding of plagiarism and academic conduct matters.

How will you be assessed?

The assessment of the taught modules will involve a combination of coursework and written examination, with the exact proportion of the two types of assessment depending on the specific module. Coursework will vary from module to module and it may include in-class tests, problem sheets, lab reports and code writing. The project will be assessed through a written dissertation, the supervisor evaluation of practical work and an oral presentation.
Programme Title: Artificial Intelligence for Drug Discovery

How is the programme structured?

Please specify the structure of the programme diets for all variants of the programme (e.g. full-time, part-time - if applicable). The description should be sufficiently detailed to fully define the structure of the diet.

The duration of the programme is 1 calendar year for FT and 2 calendar years for PT.

The programme consists of 6 15-credit taught modules (3 for each of the first two semesters), a 30-credit taught module running in semesters 1 and 2, and a 60-credit project module running in semesters 2 and 3. All modules are compulsory. The bulk of the project will be carried out in the third semester, with some preliminary work performed in the second semester. Supervision of the projects will be provided by individual members of the academic staff or by a team of academics covering the necessary range of expertise.

Semester 1
Fundamentals of Medicinal Chemistry (15 credits)
Scientific programming for drug discovery (15 credits)
Molecular modelling for drug discovery (15 credits)

Semester 2
Computational ligand-based drug discovery (15 credits)
Data-driven drug discovery (15 credits)
Fine-tuning lead compounds (15 credits)

Semesters 1 and 2
Machine and Deep Learning (30 credits)

Semesters 2 and 3
Project - Artificial Intelligence for Drug Discovery (60 credits)

Academic Year of Study FT - Year 1

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Module Code</th>
<th>Credits</th>
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<th>Semester</th>
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<tr>
<td>Fundamentals of Medicinal Chemistry</td>
<td>CHE706P</td>
<td>15</td>
<td>7</td>
<td>Compulsory</td>
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<td>Semester 1</td>
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Programme Title: Artificial Intelligence for Drug Discovery

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<tr>
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<td>Semester 2</td>
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<tr>
<td>Project - Artificial Intelligence for Drug Discovery</td>
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<td>60</td>
<td>7</td>
<td>Compulsory</td>
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<td>Semesters 2 &amp; 3</td>
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Academic Year of Study  PT - Year 1

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Academic Year of Study  PT - Year 2

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<td>2</td>
<td>Semesters 2 &amp; 3</td>
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What are the entry requirements?

UK: a 2:1 or above at undergraduate level in:
* Chemistry
* Pharmaceutical Chemistry
* Medicinal Chemistry
Programme Title: Artificial Intelligence for Drug Discovery

* Biochemistry
* Pharmacy
* Biomedical Sciences
* Any other life sciences

International:

* an international qualification of similar standing to the above.
* English language entry requirements (IELTS scores): overall >= 6.5, reading >= 5.5, writing >= 6.0, listening >= 5.5, speaking >= 5.5.

We will consider on an individual basis:
* applicants with a good 2:2 in the degrees listed above
* applicants with a 2:1 or above in degrees not listed above (e.g. physical sciences) but with relevant experience/knowledge in the subject area

How will the quality of the programme be managed and enhanced? How do we listen to and act on your feedback?

* Each individual module including the project module will be evaluated following the existing procedures in the School of Physical and Chemical Sciences. Module evaluations will be an opportunity for students to give anonymous feedback, with numerical results indicating satisfaction and free-text fields to raise any necessary concerns.

* The Student-Staff Liaison Committee (SSLC) provides a formal means of communication and discussion between the School and its students. The committee consists of student representatives from each year together with appropriate representation from staff within the school. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. The SSLC meet regularly throughout the year.

* The School operates a School Education Committee (SEC), chaired by the Director of Education (DoE), which oversees and advises on all matters relating to the delivery of taught programmes at school level including quality assurance. This includes monitoring the application of relevant QMUL policies and reviewing all proposals for module and programme approval and amendment, before submission to Taught Programmes Board. Student views are incorporated in this Committee’s work in a number of ways, such as through consideration of items referred by the SSLC and by consideration of student surveys, including module evaluation questionnaires.

* An Annual Programme Review (APR) will also take place, allowing the programme lead the opportunity to evaluate and reflect on the achievements of the programme, and in particular to document the steps taken to address both student and employer feedback.

What academic support is available?

* The School has a dedicated Student Support Officer (SSO) who is available to discuss any student-related problem. Additionally, each student will be allocated an academic advisor. SSO and advisors who will provide pastoral support and academic advice to all the students on the programme.

* At the beginning of the research project module each student will be allocated a personal research supervisor who is a member of academic staff and is the primary source of guidance on all matters relating to the research project component of the degree programme.

* Each module has a module coordinator, whose role is to ensure that the module runs smoothly, and that an appropriate level of information is provided to students of the module.

Programme-specific rules and facts

None
How inclusive is the programme for all students, including those with disabilities?

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites. Students can access advice, guidance and support in the following areas:

* Finding out if you have a specific learning difficulty like dyslexia
* Applying for funding through the Disabled Students’ Allowance (DSA)
* Arranging DSA assessments of need
* Special arrangements in examinations
* Accessing loaned equipment (e.g. digital recorders)
* Specialist one-to-one "study skills" tuition
* Ensuring access to course materials in alternative formats (e.g. Braille)
* Providing educational support workers (e.g. note-takers, readers, library assistants)
* Mentoring support for students with mental health issues and conditions on the autistic spectrum
* Reasonable adjustments will be made to the computer-based aspects of the module, for example in enabling accessible technologies, additional teaching support, and/or extra time for students with visual or motor impairments that impact routine computer use.

In addition:

* Written notes, handouts and any other asynchronous material will be provided in advance where appropriate on our digital learning platform, and in different readable formats upon request.
* Module pages on the platform will meet the baseline standard defined in the School, following the checklist for accessibility (e.g. closed captions for videos, descriptions for images etc.)
* QReview and other mixed media (e.g. Zoom) will be used in order to provide recordings of sessions.
* Microphones will be used in classrooms.
* Hard copies of all relevant books to be made available in the library, or printed copies of electronic resources provided upon request, for those that cannot read from a computer screen.
* Detailed advice from the SPCS Student Support Officer for affected students, including liaising with the QMUL disability service.

Links with employers, placement opportunities and transferable skills

Although there are no placement opportunities on the programme, academic staff involved in the programme have links with industrial drug discovery partners such as Sosei Heptares and Evotec. Graduates could also progress to careers in the AI sector not necessarily related to drug discovery or Chemistry, since the programme aims to provide them with coding skills and practical experience in the use and evaluation of AI techniques that can transferred to other fields.
Programme Title: Artificial Intelligence for Drug Discovery

Date Programme Specification approved by Taught Programmes Board:


Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

**Section 1 - Summary Information**

| Module title: Project - Artificial Intelligence for Drug Discovery | Module code: CHE701P |
| Credit value: 60 | Level: 7 | Module type: DPM | Scheme: Taught Postgraduate |
| Start date: September 2024 |
| Proposed HECoS Code: 100423 pharmaceutical chemistry |

Further details on HECoS codes can be found [here](#).

| Responsible School / Institute: School of Physical and Chemical Sciences |

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
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</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
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<tbody>
<tr>
<td>School of Physical and Chemical Sciences</td>
<td>Chemistry (PGT)</td>
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</table>
## Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
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<td>75</td>
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</tbody>
</table>

## Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is a core module of the MSc programme Artificial Intelligence for Drug Discovery. Completing an independent project is an essential component in the training of postgraduate students and their preparation for work after graduation. The module will provide the means for students to apply what learned in their taught modules and implement it in a research or applied project in Artificial Intelligence for Drug Discovery and more broadly in Computational and Pharmaceutical Chemistry. The module will develop independence and solidify core and transferable skills and depth of knowledge, in particular, mastery of one or more specialist areas or applications of Artificial Intelligence in Drug Discovery and more broadly in Pharmaceutical Chemistry.

## Resource Requirements

By School / Institute responsible for module:

Standard teaching rooms and online platforms. Computer labs with appropriate software installed such as JupyterLab + Python 3 + relevant libraries (RDKit, OpenBabel, sklear, Keras, TensorFlow, DeepChem, Pandas and libraries for data visualisation), Schrodinger Drug Discovery Suite; access to Alphafold 2; access to gpu servers.

By any other School / Institute or collaborating institution:

## Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

### Head(s) of School / Institute

Lesley Howell

**Digitally signed by Lesley Howell**

Date: 2023.05.14

21:09:05 +01'00'

### Head(s) of supporting School / Institute

### Head(s) of supporting School / Institute
Section 2 - Module Specification

Module title: Project - Artificial Intelligence for Drug Discovery  
Module code: CHE701P

Credit value: 60  
Level: 7  
Mode of Delivery: On Campus  
Semester: Semesters 2 & 3

Module Organiser: TBC

Pre-requisite modules  
Co-requisite modules  
Overlapping modules

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

The students work on research topics in one of the areas of Artificial Intelligence for drug discovery set by their project supervisors. Computational work is the principal component of the projects. The work also involves critical evaluation of previously published results. A dissertation is prepared.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

To develop skills in addressing a particular scientific drug discovery or pharmaceutical chemistry problem encompassing artificial intelligence, machine learning, data mining or other computational and theoretical approaches.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

| A1 | Advanced knowledge of methods, theories and concepts relating to the specific area of artificial intelligence, drug discovery & development and pharmaceutical chemistry in which the project is undertaken. |
| A2 | Ability to organise and critically evaluate research data and published scientific information. |
| A3 | Knowledge of conventional styles for presenting scientific data in written reports and oral presentations. |
Disciplinary Skills - able to:

B1 Carry out research using skills and tools from artificial intelligence, drug discovery & development and pharmaceutical chemistry.

B2 Prepare written scientific reports describing original work in a clear and concise way.

B3 Give a presentation on original scientific work; discuss own results in a competent way.

B4 Work independently.

B5 Select appropriate methods, tools and procedures.

Attributes:

C1 Gain experience and develop skills necessary for independent, original scientific work; develop problem-solving, IT and communication skills; learn how to collect and critically evaluate scientific information.

C2 Gain experience and learn how to present original scientific results and findings; learn how to organize time and project work.

4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.

The project-specific reading list depends on the specific project and will be provided initially by the supervisor.

Indicative reading list and topics:
- Tailored materials on literature searching using databases; how to give a presentation and poster.

5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

1. Student / lecturer interaction
Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.

2. Student independent learning time
Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

| Lectures (dissertation writing, oral communication skills, plagiarism and conduct) | ~ 8 h |
| Induction and project supervision | ~ 24h |
| project work and dissertation writing | ~ 568 h |
1. + 2. Total module notional study hours

Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

600h

6) Assessment Profile

Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dissertation</td>
<td>Dissertation (DIS)</td>
<td>7500 words</td>
<td>50</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Practical work &amp; record</td>
<td>Practical (PRA)</td>
<td>duration of module</td>
<td>20</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Oral assessment &amp; presentation</td>
<td>Practical (PRA)</td>
<td>20 min</td>
<td>30</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Final element of assessment**: The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark**: A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

Reassessment

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

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Section 3 - Alternative Assessment Arrangements for Associate Students

This section must only be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.
Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Fine-Tuning Lead Compounds
Credit value: 15
Level: 7
Module type: LSR
Start date: September 2024
Proposed HECoS Code: 100423 pharmaceutical chemistry

Further details on HECoS codes can be found here

Responsible School / Institute: School of Physical and Chemical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

| School of Physical and Chemical Sciences | Chemistry (PGT) |

Submission Date: 7 Jun 2023
### Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
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### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is a compulsory module of the MSc programme Artificial Intelligence for Drug Discovery.

Lead optimization plays a vital role in the drug discovery process and this module is designed to provide an in-depth understanding of the process. Lead compounds are compounds that show promising activity against a specific target, but often require further modification to improve their efficacy, safety, and pharmacokinetic properties.

Students will learn about the various methods and techniques used to fine-tune lead compounds, including structure-activity relationship (SAR) analysis, medicinal chemistry, synthetic viability and pharmacokinetic profiling.

This module complements the computational modules CHE703P and CHE704P.

### Resource Requirements

| By School / Institute responsible for module: | Standard teaching rooms and online platforms. |
| By any other School / Institute or collaborating institution: | |

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

Lesley Howell

Digitally signed by Lesley Howell
Date: 2023.05.14 21:09:36 +01'00''

**Head(s) of supporting School / Institute**
Section 2 - Module Specification

Module title: Fine-Tuning Lead Compounds  
Module code: CHE702P
Credit value: 15  
Level: 7  
Mode of Delivery: On Campus  
Semester: Semester 2
Module Organiser: TBC

Pre-requisite modules

CHE706P

Co-requisite modules

Overlapping modules

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

This module is designed to teach students about the process of lead compound optimization in drug discovery. Lead compounds are compounds that show promising activity against a specific target, but often require further modification to improve their efficacy, safety, and pharmacokinetic properties. Students will learn how to fine-tune lead compounds through various chemical modifications to improve their potency, selectivity, pharmacokinetics, and toxicity profiles. The module will cover topics such as structure-activity relationships, chemical modifications, synthetic viability, ligand efficiency, bioisosteres, prodrugs and ADME/Tox profiling.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

The aim of the module is to provide students with a comprehensive understanding of the lead optimization process and its impact on drug discovery. The focus is on how to use chemical modifications to improve potency, selectivity, pharmacokinetics and toxicity. This module will be complemented by the CHE703P and CHE704P modules where the computational approaches to do this will be explored. In addition, the module will also cover how to recognize if a molecule is synthetically viable.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

| A1 | Knowledge of the basic concepts and principles of ADME and toxicity and critically evaluate their role in drug discovery and development |
| A2 | Knowledge of the factors that influence the efficacy, selectivity, pharmacokinetics, and toxicity of lead compounds |
| A3 | Knowledge of the factors that impact on synthetic complexity and viability |
Disciplinary Skills - able to:

B1 Apply SAR analysis and chemical modifications to optimize lead compounds
B2 Analyze the techniques and tools used in lead optimization
B3 Evaluate the efficacy, selectivity, pharmacokinetics, and toxicity of lead compounds and make informed decisions on lead optimization
B4 Evaluate the significance of ADME/Tox profiling in drug discovery and analyse its role in optimizing lead compounds.
B5 Analyze chemical structures of lead compounds and make informed decisions on synthetic accessibility and viability.

Attributes:

C1 Communicate effectively in written and oral formats about the principle of lead optimization and critically evaluate its impact on drug discovery and development.
C2 Use information for evidence-based decision-making. Produce analyses which are grounded in experimental evidence.
C3 Acquire and apply knowledge relating to the principles and practices of lead optimisation

4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.

- An Introduction to Medicinal Chemistry by G. L. Patrick (Oxford University Press)
- Foye’s Principles of Medicinal Chemistry by T. L. Lemke and D. A. Williams (Lippincott Williams & Wilkins)
- Medical Pharmacology at a Glance by M. J. Neal (Blackwell Science)

5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

**1. Student / lecturer interaction**

Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.

<table>
<thead>
<tr>
<th>Lectures 33h (3h/week)</th>
<th>Workshops 8h</th>
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</thead>
</table>

**2. Student independent learning time**

Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

109h
1. + 2. **Total module notional study hours**

Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

<table>
<thead>
<tr>
<th>Sequence</th>
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<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
</tr>
<tr>
<td>02</td>
<td>Examination</td>
<td>Examination (EXM)</td>
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<td>50%</td>
<td>Yes</td>
<td></td>
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### Reassessment

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

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<tr>
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<td>Examination</td>
<td>Examination (EXM)</td>
<td>3h</td>
<td>100%</td>
<td>Yes</td>
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### Section 3 - Alternative Assessment Arrangements for Associate Students

This section **must only** be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click ‘Add Alternative Assessment’.
Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'. 
Module Proposal Form (PG)

Sections 1 and 2 must be completed in full.
Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Computational ligand-based drug discovery
Module code: CHE703P
Credit value: 15
Level: 7
Module type: LSR
Scheme: Taught Postgraduate
Start date: September 2024
Proposed HECoS Code: 100423 pharmaceutical chemistry

Further details on HECoS codes can be found here

Responsible School / Institute: School of Physical and Chemical Sciences

<table>
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<tr>
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Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

Responsible School / Institute | Subject Exam Board responsible for the module
---|---
School of Physical and Chemical Sciences | Chemistry (PGT)
### Anticipated Student Registrations

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### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is a compulsory module of the MSc programme Artificial Intelligence for Drug Discovery.

The module covers an important group of methods used in computational drug discovery known as 'ligand-based', where the activity/properties of candidate drugs are predicted on the basis of information on known ligands of a biological target. These approaches often make heavy use of machine learning techniques.

The aim of the module is to gradually introduce the students to the main concepts and tools of in silico ligand-based drug discovery, starting from the process of encoding the chemical structure of molecules and ending with popular machine learning methods used in QSAR and ADMET prediction.

### Resource Requirements

<table>
<thead>
<tr>
<th>By School / Institute responsible for module:</th>
<th>Standard teaching rooms and online platforms. Computer labs (~ 12 hours) with appropriate software installed (such as JupyterLab + Python 3 + RDKit, OpenBabel). Demonstrators with expertise in computer programming and Pharmaceutical Chemistry.</th>
</tr>
</thead>
<tbody>
<tr>
<td>By any other School / Institute or collaborating institution:</td>
<td></td>
</tr>
</tbody>
</table>

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

---

<table>
<thead>
<tr>
<th>Head(s) of School / Institute</th>
<th>Lesley Howell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>2023.05.14</td>
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<tr>
<td>Time</td>
<td>21:10:05 -01'00'</td>
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</tbody>
</table>

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| Head(s) of supporting School / Institute | |
|-----------------------------------------| |

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| Head(s) of supporting School / Institute | |
|-----------------------------------------| |

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| Head(s) of supporting School / Institute | |
|-----------------------------------------| |

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| Head(s) of supporting School / Institute | |
|-----------------------------------------| |
Section 2 - Module Specification

Module title: Computational ligand-based drug discovery  Module code: CHE703P

Credit value: 15  Level: 7  Mode of Delivery: On Campus  Semester: Semester 2

Module Organiser: TBC

<table>
<thead>
<tr>
<th>Pre-requisite modules</th>
<th>Co-requisite modules</th>
<th>Overlapping modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE709P, CHE706P</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

This module covers the main principles of in silico ligand-based approaches to drug discovery, with a programming component that builds upon the programming skills developed in CHE709. Topics include molecular representations, descriptors and fingerprints, molecular similarity, database searches, application of machine learning to QSAR and ADMET prediction. Tools for the critical assessment of method performance will also be presented.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

The aim of the module is to provide the students with an in-depth overview of ligand-based approaches to drug discovery with emphasis on machine learning methods. Practical labs will provide students with the tools to design and implement pipelines for the mining and analysis of chemical databases and the prediction of chemical properties in the context of drug discovery.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

| A1 | In-depth understanding of key concepts of ligand-based drug discovery including molecular representations, molecular descriptors and fingerprints, molecular similarity, QSAR and ADMET prediction |
| A2 | Ability to critically and independently assess ligand-based approaches to drug discovery based on machine learning |
Disciplinary Skills - able to:

B1 Design appropriate machine-learning based pipelines to analyse chemical databases, extract information from them and deliver predictions

B2 Select and use cheminformatics tools to solve problems in drug discovery

Attributes:

C1 Ability to effectively use digital tools to model complex concepts

C2 Ability to use statistical concepts to critically evaluate method performance

C3 Ability to communicate results clearly, concisely and accurately

4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.


5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

1. Student / lecturer interaction
Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity. lectures (~10 h) and computational labs (~12 h)

2. Student independent learning time
Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake. 128

1. + 2. Total module notional study hours
Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours. 150
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Please provide details of the assessment methods used to assess the achievement of learning outcomes.

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<tr>
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<tr>
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<td>Examination (EXM)</td>
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<td>50</td>
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**Final element of assessment:** The assessment that takes place last. There should be only ONE element of assessment marked as final.

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Reassessment
Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

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Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

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Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b)

If you wish to change the title of a module, please use the Module Amendment Form.

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**Section 1 - Summary Information**

<table>
<thead>
<tr>
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<th>Data-driven drug discovery</th>
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<td>Module type:</td>
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<td>Scheme:</td>
<td>Taught Postgraduate</td>
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<td>Start date:</td>
<td>September 2024</td>
</tr>
<tr>
<td>Proposed HECos Code:</td>
<td>100423 pharmaceutical chemistry</td>
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</table>

Further details on HECos codes can be found [here](#)

Responsible School / Institute: School of Physical and Chemical Sciences

<table>
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<tr>
<th>School / Institute</th>
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Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

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### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is as a compulsory module of the MSc programme Artificial Intelligence for Drug Discovery.

Building upon the coding and machine learning skills covered in other parts of the programme, the module introduces more advanced methods in computational drug discovery based on deep learning. Students will have the opportunity both to develop an in-depth understanding of state-of-the-art, data-driven predictive methods such as Alphafold and to learn how to implement and evaluate deep learning-based solutions to drug discovery problems.

Face-to-face teaching will be complemented by extensive hands-on sessions in the computational lab.

### Resource Requirements

**By School / Institute responsible for module:**

Standard teaching rooms and online platforms. PC labs (~ 14 hours) with appropriate software installed (JupyterLab + Python3 with DeepChem, access to Alphafold 2). Demonstrators with relevant expertise in computer programming and Chemistry.

**By any other School / Institute or collaborating institution:**

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

Head(s) of School / Institute

[Signature]

Digitally signed by Lesley Howell
Date: 2023.05.14 21:10:31 +01'00'

Head(s) of supporting School / Institute
Section 2 - Module Specification

Module title: Data-driven drug discovery
Module code: CHE704P
Credit value: 15
Level: 7
Mode of Delivery: On Campus
Semester: Semester 2
Module Organiser: TBC

Pre-requisite modules
CHE709P, CHE706P

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

The module covers advanced deep learning techniques applied to drug discovery. Topics include chemical datasets for machine learning benchmarking, deep learning for protein structure prediction, binding affinity prediction and virtual screening, and generative models for de novo drug design. Students will learn both how to use existing applications based on machine learning and how to develop deep learning pipelines in the context of drug discovery through hands-on computational sessions.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

This module aims to:
- introduce the students to state-of-the-art drug discovery techniques based on deep learning
- provide the students with the ability to apply and critically evaluate deep learning techniques in the context of drug discovery
- develop the ability of students to report and communicate the result of complex calculations in a clear and engaging way

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

| A1 | In depth understanding of deep learning methods applied to drug discovery |
| A2 | Systematic knowledge of chemical datasets for deep learning benchmarking |
### Disciplinary Skills - able to:

| B1 | Select and implement suitable deep learning solutions to problems in drug discovery |
| B2 | Critically evaluate the performance of deep learning methods in the context of drug discovery |

### Attributes:

| C1 | Ability to communicate complex ideas and concepts in a clear, concise and informative way |
| C2 | Ability to work effectively as part of a team |

### 4) Reading List

Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.

- B. Ramsundar, P. Eastman, P. Walters, V. Pande "Deep Learning for the Life Sciences", O'Reilly Media, Inc., 2019

### 5) Teaching and Learning Profile

Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

| 1. Student / lecturer interaction | lectures (~ 8h) and computational labs (~14 h) |
| 2. Student independent learning time | 128 |
| 1. + 2. Total module notional study hours | 150 |

Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.

Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

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6) Assessment Profile
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<tr>
<td>2</td>
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<td>Coursework (CWK)</td>
<td>NA</td>
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Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

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Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)
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Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Molecular Modelling for Drug Discovery  Module code: CHE705P
Credit value: 15  Level: 7  Module type: LSR  Scheme: Taught Postgraduate
Start date: September 2024
Proposed HECoS Code: 100423 pharmaceutical chemistry

Further details on HECoS codes can be found [here](#)

Responsible School / Institute: School of Physical and Chemical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
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### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is a compulsory module of the MSc programme Artificial Intelligence for Drug Discovery.

The module covers popular molecular modelling techniques for drug discovery. Emphasis is on approaches that use information on the structure of biological targets as opposed to ligand-based methods (covered by other modules in the programme). Modelling methods such as homology modelling, virtual screening and molecular dynamics simulations are presented by including both theoretical and practical aspects. The module also highlights the importance of assessing the quality and reliability of modelling.

### Resource Requirements

| By School / Institute responsible for module: | Standard teaching rooms and online platforms. Computer labs (~ 13 hours) with appropriate software installed (including Schrodinger Drug Discovery suite). Demonstrators with expertise in molecular modelling. |
| By any other School / Institute or collaborating institution: | |

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

Head(s) of School / Institute: Lesley Howell

Digitally signed by Lesley Howell Date: 2023.05.14 21:10:53 +01'00'

Head(s) of supporting School / Institute:
**Section 2 - Module Specification**

**Module title:** Molecular Modelling for Drug Discovery

**Module code:** CHE705P

**Credit value:** 15  
**Level:** 7  
**Mode of Delivery:** On Campus  
**Semester:** Semester 1

**Module Organiser:** TBC

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<th>Co-requisite modules</th>
<th>Overlapping modules</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

1) **Content Description**

Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

This module covers the main molecular modelling techniques used in drug discovery, with emphasis on structure-based approaches. Topics include protein structure, protein-ligand interactions, classical force fields, homology modelling, molecular docking, structure-based virtual screening and molecular dynamics simulations. Practical lab sessions will complement face-to-face teaching and provide the students with the opportunity to use a range of popular modelling tools for drug discovery and assess their performance.

2) **Module Aims**

Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

This module aims to:

- provide a systematic and in-depth overview of molecular modelling techniques and concepts applied to drug discovery
- develop the ability of the students to design modelling pipelines by combining existing computational tools
- develop the ability of students to critically evaluate the reliability of calculations and compare them with experimental data.

3) **Learning Outcomes**

Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

**Academic Content:**

| A1 | In depth understanding of techniques for the modelling of biomolecular systems including homology modelling, molecular docking and virtual screening, molecular dynamics simulations |
| A2 | Ability to critically assess the quality and reliability of modelling results |
Disciplinary Skills - able to:

| B1 | Design molecular modelling pipelines applied to drug discovery |
| B2 | Use a range of molecular modelling tools, interpret the results of the calculations and discuss their limitations |

Attributes:

| C1 | Ability to extract useful information from complex calculations |
| C2 | Ability to communicate results clearly, concisely and accurately |

4) Reading List
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Module Proposal Form (PG)

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If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

**Section 1 - Summary Information**

| Module title: | Fundamentals of Medicinal Chemistry |
| Credit value: | 15 | Level: 7 | Module type: LSR | Scheme: Taught Postgraduate |
| Start date: | September 2024 |
| Proposed HECos Code: | 100423 pharmaceutical chemistry |

Further details on HECos codes can be found [here](#).

| Responsible School / Institute: | School of Physical and Chemical Sciences |

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</table>

### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is a compulsory module of the MSc programme Artificial Intelligence for Drug Discovery.

The discovery and development of new drugs is critical for improving human health and treating a wide range of diseases. Medicinal chemistry plays a vital role in the drug discovery and development process by providing the fundamental knowledge and principles necessary to design and optimize drugs with improved efficacy and safety profiles. The module will provide students with a comprehensive understanding of the key principles and concepts of medicinal chemistry. The module covers topics such as the drug discovery process, drug targets, drug action and pharmacodynamics, an introduction to pharmacokinetics (ADMET), drug-receptor interactions, enzyme kinetics, and pharmacology. Students will develop the skills and knowledge necessary to critically evaluate the chemical properties and behavior of drugs. They will learn how to design and optimize drugs with improved efficacy and safety profiles from a physiochemical perspective which will complement the computational techniques covered in other modules. The module also addresses current trends and challenges in medicinal chemistry, such as the impact of genomics and/or proteomics on drug discovery, and the importance of personalized medicine.

By the end of this module, students will have a deep understanding of the principles and applications of medicinal chemistry, and be able to critically evaluate the impact of medicinal chemistry on drug discovery and development. This knowledge and skill set will be invaluable to students pursuing careers in pharmaceutical research and development, drug discovery, and related fields.

### Resource Requirements

| By School / Institute responsible for module: | Standard teaching rooms and online platforms. |
| By any other School / Institute or collaborating institution: | |

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

Lesley Howell

Digitally signed by Lesley Howell

Date: 2023.05.14 21:11:15 +01'00'
<table>
<thead>
<tr>
<th>Head(s) of supporting School / Institute</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Head(s) of supporting School / Institute</th>
<th></th>
</tr>
</thead>
</table>
Module title: Fundamentals of Medicinal Chemistry  
Module code: CHE706P  
Credit value: 15  
Level: 7  
Mode of Delivery: On Campus  
Semester: Semester 1  
Module Organiser: TBC

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

The discovery and development of new drugs is critical for improving human health and treating a wide range of diseases. Medicinal chemistry plays a vital role in the drug discovery and development process by providing the fundamental knowledge and principles necessary to design and optimize drugs with improved efficacy and safety profiles. This module equips students with a comprehensive understanding of the principles and concepts of medicinal chemistry, including drug targets, drug-receptor interactions and pharmacology. Students will develop the skills necessary to design and optimize drugs with improved efficacy and safety profiles. By the end of the module, students will be able to critically evaluate the impact of medicinal chemistry on drug discovery.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

The aim of the module is to provide students with a comprehensive understanding of the key principles underpinning medicinal chemistry and the drug discovery process. The emphasis will be on chemistry and pharmacology.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Knowledge of the basic concepts and principles of medicinal chemistry and critically evaluate their role in drug discovery and development.</td>
</tr>
<tr>
<td>A2</td>
<td>An understanding of the various techniques and tools used in drug discovery and development</td>
</tr>
<tr>
<td>A3</td>
<td>Knowledge of basic concepts in pharmacology including interaction of drugs with receptors, enzymes, ion channels and transport systems; potency, efficacy and selectivity of drugs.</td>
</tr>
</tbody>
</table>
Knowledge of the different career pathways in medicinal chemistry

### Disciplinary Skills - able to:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Analyze the basic concepts and principles of medicinal chemistry and critically evaluate their role in drug discovery and development.</td>
</tr>
<tr>
<td>B2</td>
<td>Analyze the techniques and tools used in drug discovery and development.</td>
</tr>
<tr>
<td>B3</td>
<td>Discuss the concept of drug-receptor interactions and critically evaluate how this affects drug efficacy, potency, and selectivity.</td>
</tr>
<tr>
<td>B4</td>
<td>Evaluate the role of enzyme kinetics and inhibition in drug discovery and optimization and apply this information to design more effective drugs</td>
</tr>
<tr>
<td>B5</td>
<td>Evaluate the current trends and challenges in medicinal chemistry, including the impact of genomics and proteomics on drug discovery, and synthesize this information to propose novel approaches to drug discovery.</td>
</tr>
<tr>
<td>B6</td>
<td>Identify the skills and knowledge necessary to succeed in a career in medicinal chemistry/pharmaceutical industry</td>
</tr>
</tbody>
</table>

### Attributes:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Communicate effectively in written and oral formats about the principles and applications of medicinal chemistry and critically evaluate their impact on drug discovery and development.</td>
</tr>
<tr>
<td>C2</td>
<td>Use information for evidence-based decision-making. Produce analyses which are grounded in experimental evidence.</td>
</tr>
<tr>
<td>C3</td>
<td>Acquire and apply knowledge relating to the principles and practices of medicinal chemistry.</td>
</tr>
</tbody>
</table>

### 4) Reading List

Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.

- An Introduction to Medicinal Chemistry by G. L. Patrick (Oxford University Press)
- Foye’s Principles of Medicinal Chemistry by T. L. Lemke and D. A. Williams (Lippincott Williams & Wilkins)
- Medical Pharmacology at a Glance by M. J. Neal (Blackwell Science)

### 5) Teaching and Learning Profile

Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

<table>
<thead>
<tr>
<th>Method of Delivery</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>33h (3h/week)</td>
</tr>
<tr>
<td>Workshops</td>
<td>10h</td>
</tr>
</tbody>
</table>
achievement of the learning outcomes and an indicative number of hours for each activity.

2. Student independent learning time

Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

<table>
<thead>
<tr>
<th>1. + 2. Total module notional study hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.</td>
</tr>
<tr>
<td>150h</td>
</tr>
</tbody>
</table>

6) Assessment Profile

Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Group Presentation (oral)</td>
<td>Coursework (CWK)</td>
<td>15 minutes + Q&amp;A</td>
<td>30%</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>Career Exploration Project</td>
<td>Coursework (CWK)</td>
<td>10 pages</td>
<td>20%</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Examination</td>
<td>Examination (EXM)</td>
<td>3h</td>
<td>50%</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Final element of assessment:** The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark:** A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

Reassessment

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Examination</td>
<td>Examination (EXM)</td>
<td>3h</td>
<td>100%</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
Section 3 - Alternative Assessment Arrangements for Associate Students

This section must only be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full.
Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Machine and Deep Learning
Module code: SPC707P
Credit value: 30
Level: 7
Module type: LSR
Scheme: Taught Postgraduate
Start date: September 2024
Proposed HECoS Code: 100992 machine learning

Further details on HECoS codes can be found here

Responsible School / Institute: School of Physical and Chemical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

Responsible School / Institute | Subject Exam Board responsible for the module
--------------------------------|---------------------------------------------
School of Physical and Chemical Sciences | Chemistry (PGT)
### Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024/25</td>
<td>15</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>2025/26</td>
<td>25</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>2026/27</td>
<td>35</td>
<td>15</td>
<td>75</td>
</tr>
</tbody>
</table>

### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is as a compulsory module of the MSc programme Artificial Intelligence for Drug Discovery.

The module is designed to provide a general introduction to main concepts and techniques of machine and deep learning that will be used in the rest of the programme. Emphasis is on practical aspects rather than mathematical ones. Face-to-face teaching will be complemented by extensive hands-on sessions in the computational lab. Examples of applications will be drawn from different contexts and scientific areas to develop the ability of the students to apply the acquired knowledge to unfamiliar settings. No previous knowledge of machine learning is assumed and the module is mostly self-contained except for basic coding skills, which will be provided by another other compulsory module in the programme.

### Resource Requirements

**By School / Institute responsible for module:**

Standard teaching rooms and online platforms. Computer labs (~ 30 hours) with appropriate software installed (JupyterLab + Python 3 with scikit learn, Keras and TensorFlow) and access to gpu servers. Demonstrators with relevant expertise.

**By any other School / Institute or collaborating institution:**

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

Lesley Howell

Digitally signed by Lesley Howell

Date: 2023.05.14 21:12:20 +01'00'

**Head(s) of supporting School / Institute**

**Head(s) of supporting School / Institute**

**Head(s) of supporting School / Institute**
Section 2 - Module Specification

Module title: Machine and Deep Learning
Module code: SPC707P
Credit value: 30
Level: 7
Mode of Delivery: On Campus
Semester: Semesters 1 & 2
Module Organiser: TBC

<table>
<thead>
<tr>
<th>Pre-requisite modules</th>
<th>Co-requisite modules</th>
<th>Overlapping modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHE709P for PT students</td>
<td>CHE709P for FT students</td>
<td></td>
</tr>
</tbody>
</table>

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

The module covers fundamental concepts of machine learning with emphasis on the development of practical skills required for the selection and application of machine learning methods to defined problems. Topics include data representation and preparation, unsupervised learning methods, regression and classification methods, artificial neural networks and performance evaluation. Face-to-face teaching will be combined with extensive hands-on sessions in the computational lab.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

This module aims to:
- build the knowledge in a range of machine learning methods including advanced deep learning techniques;
- provide students with the ability to design and implement machine learning pipelines to solve defined problems;
- introduce key concepts of statistics and performance evaluation that will be used in the rest of the programme.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

| A1 | In-depth understanding of the key concepts and fundamental methods of machine learning |
| A2 | Ability to select, combine and apply appropriate machine learning methods to solve defined problems |
Disciplinary Skills - able to:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Independently use suitable coding tools to implement machine learning pipelines</td>
</tr>
<tr>
<td>B2</td>
<td>Critically evaluate the performance and effectiveness of machine learning methods</td>
</tr>
</tbody>
</table>

Attributes:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Ability to use information technologies to obtain and efficiently analyse complex data</td>
</tr>
<tr>
<td>C2</td>
<td>Ability to apply acquired understanding and knowledge to unfamiliar problems</td>
</tr>
</tbody>
</table>

4) Reading List

Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.


5) Teaching and Learning Profile

Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Student / lecturer interaction</td>
<td>lectures (~17 h) and computational labs (~30 h)</td>
</tr>
<tr>
<td>2. Student independent learning time</td>
<td>253</td>
</tr>
</tbody>
</table>

1. + 2. Total module notional study hours

Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

300
6) Assessment Profile
Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In-class test</td>
<td>In-class test (EXN)</td>
<td>2 hours</td>
<td>20</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Portfolio</td>
<td>Coursework (CWK)</td>
<td>NA</td>
<td>30</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>In-class test</td>
<td>In-class test (EXN)</td>
<td>2 hours</td>
<td>20</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Programming project</td>
<td>Coursework (CWK)</td>
<td>NA</td>
<td>30</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Final element of assessment:** The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark:** A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

Reassessment
Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Programming project</td>
<td>Coursework (CWK)</td>
<td>NA</td>
<td>100</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Section 3 - Alternative Assessment Arrangements for Associate Students
This section must only be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.
Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.
Module Proposal Form (PG)

Sections 1 and 2 must be completed in full.
Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

### Section 1 - Summary Information

<table>
<thead>
<tr>
<th>Module title:</th>
<th>Scientific programming for drug discovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit value:</td>
<td>15</td>
</tr>
<tr>
<td>Start date:</td>
<td>September 2024</td>
</tr>
<tr>
<td>Proposed HECoS Code:</td>
<td>100423 pharmaceutical chemistry</td>
</tr>
</tbody>
</table>

Further details on HECoS codes can be found [here](#).

| Responsible School / Institute: | School of Physical and Chemical Sciences |

**School / Institute** | **% of total teaching to be delivered**
--- | ---
X |  |

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

<table>
<thead>
<tr>
<th>Collaborating Institution</th>
<th>Percentage Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Physical and Chemical Sciences</td>
<td>Chemistry (PGT)</td>
</tr>
</tbody>
</table>
Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024/25</td>
<td>15</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>2025/26</td>
<td>25</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>2026/27</td>
<td>35</td>
<td>15</td>
<td>75</td>
</tr>
</tbody>
</table>

Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is as a compulsory module of the MSc programme Artificial Intelligence for Drug Discovery.

The module covers fundamental concepts of scientific programming that will be used for the rest of the programme. No previous knowledge/experience of coding is assumed. The first part of the module introduces the main syntactic elements of a programming language, while the second part covers the use of libraries for the acquisition, analysis and visualisation of data relevant for drug discovery. Emphasis is on the development of practical coding skills with plenty of computer lab sessions.

Resource Requirements

By School / Institute responsible for module:

Standard teaching rooms and online platforms. Computer labs (~ 20 hours) with appropriate software installed (JupyterLab + Python 3 with RDKit, Pandas and libraries for data visualisation). Demonstrators with expertise in computer programming and Chemistry.

By any other School / Institute or collaborating institution:

Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

Head(s) of School / Institute

Lesley Howell

Digitally signed by Lesley Howell
Date: 2023.05.14 21:11:35 +01'00'

Head(s) of supporting School / Institute

Head(s) of supporting School / Institute
Section 2 - Module Specification

Module title: Scientific programming for drug discovery
Module code: CHE709P

Credit value: 15 Level: 7 Mode of Delivery: On Campus Semester: Semester 1

Module Organiser: TBC

Pre-requisite modules Co-requisite modules Overlapping modules

SPC707P for FT students

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

This module covers key concepts of scientific programming including variables, data structures, control flow, regular expressions, functions and libraries for data analysis and visualisation. Use of coding to query chemical databases will also be introduced. Face-to-face teaching will be followed by practical sessions in the computer lab, where student will have the opportunity to build their coding skills and apply them to data analysis and visualisation in the context of drug discovery using an integrated development environment such as JupyterLab. The module does not assume any previous knowledge/experience of programming.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

This module aims to:
- build the knowledge in key programming concepts required for the identification, use and development of tools for in silico drug discovery;
- provide students with the necessary training to write, test, document and share their own code to solve problems related to drug discovery;
- introduce scientific libraries and databases for drug discovery applications that will be used in the rest of the programme.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

| A1 | Systematic understanding of main elements of a programming language, including variables, data structures, control flow, regular expressions, functions and libraries |
| A2 | Ability to select appropriate databases for drug discovery applications; knowledge of associated file formats |
Disciplinary Skills - able to:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Use integrated programming environments to write, test, document and share scientific code</td>
</tr>
<tr>
<td>B2</td>
<td>Use programming to search databases relevant for drug discovery</td>
</tr>
<tr>
<td>B3</td>
<td>Select, combine and use appropriate software libraries to analyse and visualise complex data in the context of drug discovery</td>
</tr>
</tbody>
</table>

Attributes:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Ability to use information technologies to obtain and efficiently analyse complex data</td>
</tr>
<tr>
<td>C2</td>
<td>Ability to communicate complex information through effective data visualisation</td>
</tr>
</tbody>
</table>

4) Reading List

Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.


5) Teaching and Learning Profile

Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

| 1. Student / lecturer interaction | lectures (~10 h) and computational labs (~20 h) |
| 2. Student independent learning time | 120 |
| 1. + 2. Total module notional study hours | 150 |
6) Assessment Profile
Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>In-class test</td>
<td>In-class test (EXN)</td>
<td>2 hours</td>
<td>40</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Programming project</td>
<td>Coursework (CWK)</td>
<td>NA</td>
<td>60</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Final element of assessment:** The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark:** A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

Reassessment
Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- ☐ Standard Reassessment
- ☐ Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Programming project</td>
<td>Coursework (CWK)</td>
<td>100</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Section 3 - Alternative Assessment Arrangements for Associate Students
This section must only be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click ‘Add Alternative Assessment’.

Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)
This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click ‘Add Half Module (Semester A)’. 
Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Part 2 Programme Proposal Form

All sections must be completed in full and supplementary information attached where requested. Part 2 proposals should be submitted with the documentation listed below, to the Academic Secretariat who will arrange for the consideration of the proposal at Taught Programmes Board:

- Programme Specification
- External Adviser Feedback Form(s)
- Module Proposal Forms for any new modules forming part of the proposed programme
- Draft Memorandum of Agreement (for any programme proposals involving a collaborative partner)

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Summary Information

Proposed Programme Title: Artificial Intelligence and Machine Learning in Science

Proposed Programme and Route Code(s):

<table>
<thead>
<tr>
<th>Award</th>
<th>Mode of study</th>
<th>Programme Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master of Science (MSc)</td>
<td>Full-time</td>
<td>1 academic year</td>
</tr>
<tr>
<td>Master of Science (MSc)</td>
<td>Part-time</td>
<td>2 academic years</td>
</tr>
</tbody>
</table>

Proposed start date: September 2024

Proposed term dates: Standard

Does this programme contain a foundation year or any pre-sessional activity? Yes

Will this programme be available to Science & Engineering Foundation (SEFP) students after completion of the foundation year? N/A
1) Programme Management
Please describe the arrangements for the operational management of the programme and the quality assurance and enhancement mechanisms that will be put in place. Consideration should be given to student representatives and hearing student views.

Please complete either section a) for programmes delivered by one QMUL School / Institute or section b) for programmes delivered by more than one QMUL School / Institute. Programme management arrangements for collaborative programmes should also be reflected in the Memorandum of Agreement with the partner institution.

a) Single School / Institute Delivery

b) Joint School / Institute Delivery
For programmes that are delivered jointly between more than one QMUL School / Institute or for programmes that utilise modules from other QMUL Schools / Institutes in an interdisciplinary capacity, a separate joint working statement signed by all relevant Heads of Schools / Institutes should also be provided. This should identify the respective responsibilities of each QMUL School / Institute with regards to programme management, quality assurance, enhancement, and student support, and should be reviewed on an annual basis.

This programme will be managed by the School of Physical and Chemical sciences (SPCS) who are the lead school. SPCS will take overall responsibility for the recruiting, admissions and induction of students to the programme. The programme director will be a member of SPCS and report to the SPCS Director of Education (DoE). The Programme Director will attend the SPCS School Education Committee (SEC) who oversee all aspects of Education in SPCS including quality assurance.
The School of Mathematical Sciences will contribute to the delivery of half the modules available (considering core, compulsory and elective modules).

Advisors and project supervisors will be from SPCS and SMS. Progression will be overseen by the Physics PGT School Exam Board. Colleagues from Chemistry and SMS who teach on the programme will be invited to this SEB. They will also be invited to join the SEC as and when appropriate.
The SPCS student support officer, Senior Tutor and Advisors will provide pastoral support and (academic) advice to all students on the programme. To address student feedback, a student representative from the programme will be invited to join the staff-student liaison committee which meets on a regular basis to address student feedback.
SPCS also has a new student feedback process which launches in 2023/24. This is based on forms which student reps can complete with concerns and feedback in advance of the Student-Staff Liaison Committee (SSL). These are discussed with colleagues from the Professional Services side of the Education Leadership team before being discussed with the relevant DTL or DoE. Appropriate actions will be taken to address any concerns raised.
Each individual module, including the project modules, will be evaluated following the existing procedures in SPCS. These module evaluations will be an opportunity for students to give anonymous feedback on the modules, with numerical results indicating satisfaction and free-text fields to raise any necessary concerns.
An Annual Programme Review (APR) will take place, allowing the programme lead the opportunity to evaluate and reflect on the achievements of the programme, and in particular to document the steps taken to address both student and employer feedback.
2) Accessibility and inclusivity
Please describe how you have factored in the needs of all students for this programme, including those with disabilities and those who are neurodiverse (e.g. have dyslexia, AD(H)D, autism). Considerations of this nature should include the following:
- Are the learning outcomes for the programme and each module clear?
- Have all reading lists been reviewed in the last academic year with consideration given to texts that are available electronically as well as in hard copy?
- Have all reading lists been included on the Reading Lists Online resource available from Library Services?
- How much of the teaching will be made available via Q-Review and when will recordings be released to students?
- Has QMPlus content been checked for accessibility standards with the E-Learning Unit?

Further information and guidance on inclusive practice can be found on the Disability and Dyslexia Service's website.

The following steps will be taken to ensure access in classroom-based modules to ensure accessibility:
* All QMPlus modules will meet the baseline standard defined in the School, following the checklist for accessibility
* Written notes, handouts and any other asynchronous material provided at least 1 week in advance where appropriate, and in different readable formats upon request.
* Videos will have closed captions provided
* All images will have ALT text provided
* Microphones will be used in classrooms
* Active learning: the primary delivery mode for teaching will be “flipped classroom”, with asynchronous tasks on QMPlus followed by interactive sessions that build on the understanding from those tasks.
* Use of QReview and other mixed media (e.g. Zoom) in order to provide recordings of sessions.
* Hard copies of all relevant books to be made available in the library, or printed copies of electronic resources provided upon request, for those that cannot read from a computer screen.
* Detailed advice from the SPCS Student Support Officer for affected students, including liaising with the QMUL disability service.
* Extra time provided in assessments where required
* Teaching sessions will have a 10 minute break after each 50 minute period.
* Learning outcomes will be made objective and accessible for each module, and connect directly to the Skills, Knowledge, and competencies defined in the programme benchmark.

In addition, reasonable adjustments will be made to the computer-based aspects of the module, for example in enabling accessible technologies, additional teaching support, and/or extra time for students with visual or motor impairments that impact routine computer use.

3) Plagiarism Detection
Consideration should be given to the use of plagiarism detection software e.g. turnitin, for programmes with a significant proportion of written assessed work. Please provide information about how this will be managed for the programme.

Standard plagiarism detection will be used, with assessed work checked by Turnitin after submission on QMPlus. Suspected cases will be dealt with according to the QMUL Academic Misconduct Policy.

4) Academic Staffing for the programme (non-QMUL staff)
Please list any academic staff that are not employed or managed by QMUL that will be involved in the teaching or assessment of the programme. For collaborative programmes, this list should include staff from the partner institution(s) who will be involved in delivering the proposed programme.

N/A
5) Distance Learning Programmes (if applicable)
If the programme is to be delivered via distance learning, please describe the specific arrangements in place to ensure the quality of distance learning provision. Particular consideration should be given to enrolment, assessment, provision of learning materials, and student support. All proposals for new distance learning programmes should be discussed with the e-Learning team.

N/A

6) Subject Examination Board Details
Please specify the name of the Subject Examination Board (SEB), which will oversee the assessment processes that operate for the programme(s) and modules [clarify whether this is a new or existing SEB]. For further information please contact [Simon Hayter].

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Physical and Chemical Sciences</td>
<td>Physics and Astronomy (PGT)</td>
</tr>
</tbody>
</table>

The following documents must accompany the Part 2 Programme Proposal. Proposals that are not accompanied by the necessary documentation will not be considered by Taught Programmes Board.

- Has a Programme Specification been completed and submitted with the Part 2? [Yes]
- Have module proposal forms for each new module been submitted with the Part 2? [Yes]
- Has at least one External Adviser Feedback Form been submitted with the Part 2? [Yes]
- If any special regulations are required for the proposed programme, have these been clearly documented and/or appended? [N/A]

Collaborative provision: programmes that are offered in partnership with an external organisation should usually have the following documents appended to the Part 2 Programme Proposal.

- Has a draft Memorandum of Agreement been submitted with the Part 2? [N/A]

Approval of Part 2 Programme Proposal

The signature of the Heads of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).
<table>
<thead>
<tr>
<th>Head(s) of School</th>
<th>Head(s) of supporting School</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head(s) of supporting School</td>
<td>Head(s) of supporting School</td>
</tr>
<tr>
<td>Head(s) of supporting School</td>
<td>Head(s) of supporting School</td>
</tr>
</tbody>
</table>

Chair of Taught Programmes Board

Once a programme has passed Part 2 approval offers can be made to applicants. For programmes that are offered in partnership with an external organisation, offers cannot be made until the Memorandum of Agreement has been signed. This will be arranged by the Academic Secretariat.
Programme Specification (PG)

<table>
<thead>
<tr>
<th>Awarding body / institution:</th>
<th>Queen Mary University of London</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching institution:</td>
<td>Queen Mary University of London</td>
</tr>
<tr>
<td>Name of final award and title:</td>
<td>Master of Science in Artificial Intelligence and Machine Learning in Science</td>
</tr>
<tr>
<td>Name of interim award(s):</td>
<td>PG Cert/PG Dip</td>
</tr>
<tr>
<td>Duration of study / period of registration:</td>
<td>12 months (FT), 24 months (PT)</td>
</tr>
<tr>
<td>Queen Mary programme code(s):</td>
<td></td>
</tr>
<tr>
<td>QAA Benchmark Group:</td>
<td>Computing</td>
</tr>
<tr>
<td>FHEQ Level of Award:</td>
<td>Level 7</td>
</tr>
<tr>
<td>Programme accredited by:</td>
<td></td>
</tr>
<tr>
<td>Date Programme Specification approved:</td>
<td></td>
</tr>
<tr>
<td>Responsible School / Institute:</td>
<td>School of Physical and Chemical Sciences</td>
</tr>
</tbody>
</table>

Schools / Institutes which will also be involved in teaching part of the programme:

- School of Mathematical Sciences

Collaborative institution(s) / organisation(s) involved in delivering the programme:

Programme outline

The need to collect, analyse, model, understand and interpret big data is permeating all aspects of society. Artificial Intelligence (AI) is creating a revolution in all fields, thanks to the advancements in computational power, and the increased availability both of efficient algorithms and of high-quality data. Machine learning, advanced data analysis techniques, and interpretation skills adapted to a wide range of scenarios are not part of the training and skills in undergraduates of traditional STEM programmes. Consequently, there is a significant high demand for professionals with the breadth of knowledge, skills and tools that this programme supported by the Schools of Physical and Chemical Sciences and Mathematical Sciences provides.

The MSc programme in Artificial Intelligence and Machine Learning in Science will cover:
- Fundamentals of Probability and Statistics
- Scientific programming
- Supervised and unsupervised machine learning methods
- Deep learning methods
- Modelling and simulation techniques applied to a wide range of datasets
- Big Data management, visualisation and analysis.
Programme Title: Artificial Intelligence and Machine Learning in Science

The programme is taught by experts from the two Schools and all departments in them, and it focuses on developing the students' experience on the most interesting and new datasets that only active researchers can access and explore together with the students. The students' interests will be matched to a wide variety of topic-specific modules and projects allowing them to develop their skills on relevant scientific datasets.

The delivery of the programme will involve a combination of face-to-face teaching and interactive workshops to cover the theoretical and topic-specific aspects of the programme. Students will have the opportunity to develop practical coding skills and use state-of-the-art software in extensive computer lab sessions. Students will acquire unique research experience by carrying out a research-based project where they will expand the concepts and tools learnt in the taught modules to high profile cutting-edge topics.

Highlights:
- New programme with a unique and comprehensive combination of topics in Artificial Intelligence and cutting-edge applications.
- Emphasis on big data applications in a wide range of research fields.
- No previous knowledge of coding and machine learning is assumed.

Aims of the programme

The aim of the MSc programme in Artificial Intelligence and Machine Learning in Science is to provide students with the breadth and depth of knowledge required to apply state-of-the art analysis and modelling techniques to the widest contexts, interpret the resulting predictions and assess their quality. The wide range of competences required for the delivery of the programme is provided by academic staff in the School of Physical and Chemical Sciences and in the School of Mathematical Sciences.

More specifically, the programme aims to:

* Provide students with an in-depth understanding of a range of topics including principles of probability and statistics, data management, visualisation and analysis, machine learning and deep learning tools and models.

* Develop practical coding skills essential to apply artificial intelligence to the any field and any dataset.

* Develop analytical and critical skills for assessing and developing the tools needed for data modelling.

* Enable students to acquire substantial research experience through a final research-based project.

This programme will equip students with the knowledge, skills and competencies to address the widest variety of problems and datasets. Specifically, it will generate highly skilled graduates better prepared for a career as data scientists. This data-centred programme enables the graduates to develop their skills in the field they consider more interesting with a variety of datasets available and, then, transfer their experience and knowledge to the widest range of fields.

What will you be expected to achieve?

Students who successfully complete the programme are expected to possess the following knowledge/skills/attributes:

Academic Content:

A 1 Knowledge and understanding of key theory concepts and practical applications of probability and statistics.
Programme Title: Artificial Intelligence and Machine Learning in Science

| A2 | In depth knowledge of key theory concepts and practical aspects of artificial intelligence methods. |
| A3 | In depth knowledge of key concepts and practical aspects of data management, exploration and visualisation. |
| A4 | Ability to engage critically and reflectively with different sources of scientific literature and science-informed models. |

Disciplinary Skills - able to:

| B1 | Independently identify, select, combine and use computational tools to manage, analyse, and visualise datasets. |
| B2 | Critically assess and reflect on the performance and reliability of machine learning and modelling methods. |
| B3 | Write, test and document scientific code to perform a range of tasks, including searching and extracting information from databases, performing predictions, analysing and visualising data. |
| B4 | Conduct and report on a significant piece of research work related to the problems and challenges of machine learning applications. |

Attributes:

| C1 | Ability to use problem-solving skills and computational tools to solve unfamiliar problems |
| C2 | Ability to communicate complex ideas and concepts in a clear, concise and informative way that is appropriate for the audience |
| C3 | Ability to work with information that may be incomplete or uncertain |
| C4 | Ability to work effectively as part of a team |
| C5 | Ability to manage time, prioritise workload and work to deadlines |

How will you learn?

Acquisition of knowledge and understanding in taught modules will generally be achieved by on campus face-to-face teaching and interactive workshops. These will be complemented and supported by extensive online content (videos, slides, practice questions etc...) that will be made available before each session.

The programme has a strong emphasis on the development of practical skills, including coding and report writing, which will be achieved through extensive computer lab sessions. Individual support will be provided during these sessions by academic and research staff to reinforce theory and concepts covered in face-to-face teaching sessions.

The ability to assess and characterise datasets, independently evaluate and compare models and their performances will be also developed through coursework based on the critical assessment of the practical work on a variety of datasets. The project module will give the students the opportunity to develop research, communication and reporting skills through weekly support provided by the supervisory team. Additional taught sessions in this module will provide support for the development of writing and oral communication skills, and for the understanding of plagiarism and academic conduct matters.

How will you be assessed?

The assessment of the taught modules will involve a combination of coursework and written examination, with the exact
Programme Title: Artificial Intelligence and Machine Learning in Science

The proportion of the two types of assessment depending on the specific module. Coursework will vary from module to module and it may include in-class tests, problem sheets, lab reports and code writing. The project will be assessed through a written dissertation, the supervisor evaluation of practical work and an oral presentation.

How is the programme structured?
Please specify the structure of the programme diets for all variants of the programme (e.g. full-time, part-time - if applicable). The description should be sufficiently detailed to fully define the structure of the diet.

The duration of the programme is 1 calendar year for FT and 2 calendar years for PT.

The programme consists of 6 15-credit taught modules (3 for each of the first two semesters), a 30-credit taught module running in semesters 1 and 2, and a 60-credit project module running in semesters 2 and 3.
Two modules are core (the project 60-credit module and the Machine and Deep Learning 30-credit module) and two module are compulsory (two modules in term A).
The bulk of the project will be carried out in the third semester, with some preliminary work performed in the second semester. Supervision of the projects will be provided by individual members of the academic staff or by a team of academics covering the necessary range of expertise.

Semester 1
Compulsory modules:

Choose one from these elective modules:

Semesters 1 and 2
Core module:

Semester 2
Choose three from these elective modules so that at least one is selected within each subgroup:
* Subgroup A of elective modules: deepening technical or theoretical knowledge
* Subgroup B of elective modules: exploring applications in specific fields
  SPC723P [7] ML in Materials Discovery [SPCS] (15 credits)

Semesters 2 and 3
Core module:
SPC720P [7] Research Project in Data Science (60 credits)

For the part-time programme:

Year 1:
Semester 1
Compulsory modules:

Semesters 1 and 2
Core module:

Semester 2
Choose one from these elective modules:
Elective modules:
SPC723P [7] ML in Materials Discovery [SPCS] (15 credits)

Year 2:
Semester 1:
+ Choose one from Semester 1 elective modules

Semester 2
Choose two from Semester 2 elective modules, one from within each of 2 subgroups.

Semesters 2 and 3
Core module:
SPC720P [7] Research Project in Data Science (60 credits)

Academic Year of Study FT - Year 1

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Module Code</th>
<th>Credits</th>
<th>Level</th>
<th>Module Selection Status</th>
<th>Academic Year of Study</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability and Statistics</td>
<td>MTH794P</td>
<td>15</td>
<td>7</td>
<td>Compulsory</td>
<td>1</td>
<td>Semester 1</td>
</tr>
<tr>
<td>Programming with Python</td>
<td>MTH766P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
<td>1</td>
<td>Semester 1</td>
</tr>
<tr>
<td>Topics in Scientific Computing</td>
<td>MTH739P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
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<td>Semester 1</td>
</tr>
<tr>
<td>Research Methods</td>
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<td>15</td>
<td>7</td>
<td>Compulsory</td>
<td>1</td>
<td>Semester 1</td>
</tr>
<tr>
<td>Machine and Deep Learning</td>
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<td>30</td>
<td>7</td>
<td>Core</td>
<td>1</td>
<td>Semesters 1 &amp; 2</td>
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<tr>
<td>Bayesian Statistics</td>
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<td>7</td>
<td>Elective</td>
<td>1</td>
<td>Semester 2</td>
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</table>
### Programme Title: Artificial Intelligence and Machine Learning in Science

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Module Code</th>
<th>Credits</th>
<th>Level</th>
<th>Module Selection Status</th>
<th>Academic Year of Study</th>
<th>Semester</th>
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<tbody>
<tr>
<td>Time Series Analysis for Business</td>
<td>MTH783P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
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<td>Semester 2</td>
</tr>
<tr>
<td>Graphs and Networks</td>
<td>MTH705P</td>
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<td>7</td>
<td>Elective</td>
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<td>Semester 2</td>
</tr>
<tr>
<td>AI in Astrophysics and Space Science</td>
<td>SPC722P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
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<td>Semester 2</td>
</tr>
<tr>
<td>ML in Materials Discovery</td>
<td>SPC723P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
<td>1</td>
<td>Semester 2</td>
</tr>
<tr>
<td>Cloud Computing in AI</td>
<td>SPC724P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
<td>1</td>
<td>Semester 2</td>
</tr>
<tr>
<td>Research Project in Data Science</td>
<td>SPC720P</td>
<td>60</td>
<td>7</td>
<td>Core</td>
<td>1</td>
<td>Semesters 2 &amp; 3</td>
</tr>
</tbody>
</table>

#### Academic Year of Study  FT - Year 1

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Module Code</th>
<th>Credits</th>
<th>Level</th>
<th>Module Selection Status</th>
<th>Academic Year of Study</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probability and Statistics</td>
<td>MTH794P</td>
<td>15</td>
<td>7</td>
<td>Compulsory</td>
<td>1</td>
<td>Semester 1</td>
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<tr>
<td>Machine and Deep Learning</td>
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<td>30</td>
<td>7</td>
<td>Core</td>
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<td>Semesters 1 &amp; 2</td>
</tr>
<tr>
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<td>15</td>
<td>7</td>
<td>Elective</td>
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<td>Semester 2</td>
</tr>
<tr>
<td>Time Series Analysis for Business</td>
<td>MTH783P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
<td>1</td>
<td>Semester 2</td>
</tr>
<tr>
<td>Graphs and Networks</td>
<td>MTH705P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
<td>1</td>
<td>Semester 2</td>
</tr>
<tr>
<td>AI in Astrophysics and Space Science</td>
<td>SPC722P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
<td>1</td>
<td>Semester 2</td>
</tr>
<tr>
<td>ML in Materials Discovery</td>
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<td>7</td>
<td>Elective</td>
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<td>Semester 2</td>
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<tr>
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<td>15</td>
<td>7</td>
<td>Elective</td>
<td>1</td>
<td>Semester 2</td>
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</table>

#### Academic Year of Study  FT - Year 2
Programme Title: Artificial Intelligence and Machine Learning in Science

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Module Code</th>
<th>Credits</th>
<th>Level</th>
<th>Module Selection Status</th>
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<th>Semester</th>
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<tbody>
<tr>
<td>Research Methods</td>
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<td>7</td>
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<td>Programming with Python</td>
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<td>Topics in Scientific Computing</td>
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<td>Semester 2</td>
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<td>Elective</td>
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<td>Semester 2</td>
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<tr>
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<td>15</td>
<td>7</td>
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<td>Semester 2</td>
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<tr>
<td>ML in Materials Discovery</td>
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<td>7</td>
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<td>Semester 2</td>
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<tr>
<td>Cloud Computing in AI</td>
<td>SPC724P</td>
<td>15</td>
<td>7</td>
<td>Elective</td>
<td>2</td>
<td>Semester 2</td>
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<tr>
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<td>60</td>
<td>7</td>
<td>Core</td>
<td>2</td>
<td>Semesters 2 &amp; 3</td>
</tr>
</tbody>
</table>

What are the entry requirements?

UK: a 2:1 or above at undergraduate level in:
* Mathematics
* Physics
* Chemistry
* Computing
* Engineering
* Any other STEM subjects

International:
* an international qualification of similar standing to the above.
* English language entry requirements (IELTS scores): overall >= 6.5, reading >= 5.5, writing >= 6.0, listening >= 5.5, speaking >= 5.5.

We will consider on an individual basis:
* applicants with a good 2:2 in the degrees listed above
* applicants with a 2:1 or above in degrees not listed above but with relevant experience/knowledge in the subject area

How will the quality of the programme be managed and enhanced? How do we listen to and act on your feedback?

* Each individual module including the project module will be evaluated following the existing procedures in the School of Physical and Chemical Sciences. Module evaluations will be an opportunity for students to give anonymous feedback, with
numerical results indicating satisfaction and free-text fields to raise any necessary concerns.

* The Student-Staff Liaison Committee (SSLC) provides a formal means of communication and discussion between the School and its students. The committee consists of student representatives together with appropriate representation from staff within the school. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. The SSLC meet regularly throughout the year.

* The School operates a School Education Committee (SEC), chaired by the Director of Education (DoE), which oversees and advises on all matters relating to the delivery of taught programmes at school level including quality assurance. This includes monitoring the application of relevant QMUL policies and reviewing all proposals for module and programme approval and amendment, before submission to Taught Programmes Board. Student views are incorporated in this Committee’s work in a number of ways, such as through consideration of items referred by the SSLC and by consideration of student surveys, including module evaluation questionnaires.

* An Annual Programme Review (APR) will also take place, allowing the programme lead the opportunity to evaluate and reflect on the achievements of the programme, and in particular to document the steps taken to address both student and employer feedback.

What academic support is available?

* The School has a dedicated Student Support Officer (SSO) who is available to discuss any student-related problem. Additionally, each student will be allocated an academic advisor. SSO and advisors will provide pastoral support and academic advice to all the students on the programme.

* At the beginning of the research project module each student will be allocated a personal research supervisor who is a member of academic staff and is the primary source of guidance on all matters relating to the research project component of the degree programme.

* Each module has a module coordinator, whose role is to ensure that the module runs smoothly, and that an appropriate level of information is provided to students of the module.

Programme-specific rules and facts

None

How inclusive is the programme for all students, including those with disabilities?

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites. Students can access advice, guidance and support in the following areas:

* Finding out if you have a specific learning difficulty like dyslexia
* Applying for funding through the Disabled Students’ Allowance (DSA)
* Arranging DSA assessments of need
* Special arrangements in examinations
* Accessing loaned equipment (e.g. digital recorders)
* Specialist one-to-one “study skills” tuition
* Ensuring access to course materials in alternative formats (e.g. Braille)
* Providing educational support workers (e.g. note-takers, readers, library assistants)
* Mentoring support for students with mental health issues and conditions on the autistic spectrum
* Reasonable adjustments will be made to the computer-based aspects of the module, for example in enabling accessible
Programme Title: Artificial Intelligence and Machine Learning in Science

Technologies, additional teaching support, and/or extra time for students with visual or motor impairments that impact routine computer use.

In addition:
* Written notes, handouts and any other asynchronous material will be provided in advance where appropriate on our digital learning platform, and in different readable formats upon request.
* Module pages on the platform will meet the baseline standard defined in the School, following the checklist for accessibility (e.g. closed captions for videos, descriptions for images etc.)
* QReview and other mixed media (e.g. Zoom) will be used in order to provide recordings of sessions.
* Microphones will be used in classrooms.
* Hard copies of all relevant books to be made available in the library, or printed copies of electronic resources provided upon request, for those that cannot read from a computer screen.
* Detailed advice from the SPCS Student Support Officer for affected students, including liaising with the QMUL disability service.

Links with employers, placement opportunities and transferable skills

Although there are no placement opportunities on the programme, academic staff involved in the programme have national and international experience in their respective research fields and regularly work with internal and external partners (DERI, Turing Institute, AWE, etc.). Graduates could also progress to careers in data science in the widest range of fields, since the programme aims to provide them with coding skills and practical experience in the use and evaluation of AI techniques that can transferred to most fields. Most employers require project and coding developments in the context of job interviews. This programme and in particular the "Research Method" module will train the graduates to address these styles of interviews.

Programme Specification Approval

| Person completing Programme Specification: | Marcella Bona |
| Person responsible for management of programme: | Marcella Bona |
| Date Programme Specification produced / amended by School / Institute Education Committee: | 07/06/2023 (Chair’s action) |
| Date Programme Specification approved by Taught Programmes Board: | |
External Adviser Feedback Form

Purpose

External Advisers are usually members of academic staff external to Queen Mary, who are asked to comment on proposals for new undergraduate or postgraduate taught programmes in accordance with the above guidelines.

External Advisers should expect to receive and review:
- Part 2 Programme Proposal Form
- Programme Specification
- Module Proposal Forms for any new modules

Scope

External Advisers are asked to provide feedback on each of the areas listed below, in relation to the proposed programme. Please note that this list is not exhaustive, and Advisers are encouraged to comment on any aspect of the proposal; drawing on their own knowledge and experience. As a guide, an external advisor’s report for a standard undergraduate or taught masters programme would normally be in the region of two to four sides of A4.

External Adviser details

<table>
<thead>
<tr>
<th>Name &amp; Title of External Adviser:</th>
<th>Dr David Hutchcroft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Post &amp; Institution / Organisation:</td>
<td>Senior Lecturer, University of Liverpool</td>
</tr>
<tr>
<td>Email address for correspondence:</td>
<td><a href="mailto:David.Hutchcroft@cern.ch">David.Hutchcroft@cern.ch</a></td>
</tr>
<tr>
<td>I confirm that I have received and reviewed the documentation listed above:</td>
<td>Yes</td>
</tr>
</tbody>
</table>

1. Aims, objectives and learning outcomes

- Does the programme have clearly articulated aims and learning outcomes which appear to meet the needs of students and equip them for further study or employment?
- Do the academic standards in subject content and teaching and learning match the aims and learning outcomes?
- Are all programme learning outcomes met within modules?
- Are the learning outcomes and the expectations of students clearly developed throughout the programme?

The course addresses a potential pool of students looking for an MSc in Data Science. The introductory outline suggests this is specifically targeted at STEM graduates.

There may be a larger pool of applicants, computer science and engineering graduates for example, might also want to upskill with this course. The module descriptions all have “will take a cohort of students from a broad set of backgrounds, from both the home and overseas markets” which seems like the course will be suitable for a wide range of potential students.
The graduates of this course would be suitable for many roles in data science, which have identified by the government as a area with a skills gap.²

The course is similar to others operating elsewhere in UK universities and meets the same standard of rigour they do. There is an extended project where 600 hours of work on developing a machine learning project around research in the Physics, Chemistry or Maths departments. This will act as a capstone on the previous modules giving skills to actually do this research. This provides the feedback and motivation for the taught modules in the course where the students can see their prior learning being used in this later work.

There is a programme level academic content item “A3 In depth knowledge of key concepts and practical aspects of data management, exploration and visualisation”. Which is covered in the compulsory “Research methods” module, however both data management and visualisation are not explicit learning outcomes from that module. The research module should have its content and skills adjusted to match the programme level ones. The other academic content items seem to be covered.

Overall, I was very happy with the programme structure; this should be a course that meets the needs of the students. The mix of existing module and new ones should mean the students experience a well-developed course. However as I note below, the induction process should be carefully handled to avoid students being overwhelmed initially by the density of high level maths and computing concepts delivered in the first semester.

2.a. Curriculum, design, content and organisation

- Does the design and content of the curricula support student learning, and the achievement of the intended learning outcomes?
- Does the content and design of the curricula aid progression through the programme?
- Is the specialist content of the programme up to date and comparable with that of similar programmes elsewhere?
- Is the structure of the programme clearly defined and explained?
- Is the credit structure appropriate for a programme of the assigned level?
- Is the student workload appropriately balanced across the academic year?
- Does the programme include appropriate careers education?
- Is consideration given to work-based and placement learning?
- Are professional practice requirements noted where relevant?
- Have equal opportunities been considered in the development?

The curriculum is well designed to support the students progressing from little if any familiarity with ML techniques to having a high level of skill, with an extended project acting as a showcase for their skill to demonstrate that to potential employers.

The modules do provide the background required and specialist skills to apply ML in an astrophysics, chemistry, physics or mathematics context. Once the skills are learned however they are widely applicable, the only issue may be the lack of exposure to natural language processing. This is common in many ML fields but the STEM subjects tend to only use ML modules that process numerical data. A future optional module on language processing could be an extension.

The modules are well matched to similar courses at other Universities, I am specifically very familiar with courses at the University of Liverpool and Liverpool John Moores University as our centre for doctoral training LIV.INNO uses those modules as part of the training programme. The amount and level of material seems very similar and my understanding is that the team at QMUL has the expertise to teach the material they propose to at the high standard the students will expect.

With the structure looks well thought out and should be both achievable but quite an intense 12 months of study for a full-time student, with a well thought through part-time route taking two years.

There are 60 credits in each semester and this is the normal workload for an MSc student. The classroom modules are front loaded which means the skills have been acquired before the extended project in semester 3.

There is no explicit careers education mentioned other than that QMUL staff have links to organisations working in these spaces so may be able to offer advice using those contacts. An explicit session with members of the QMUL careers service both as an induction event and another in March/April when students may be considering applying for jobs could be very useful for the cohort. They would obviously be able to contact the careers service at any time, as can any student, but a dedicated session may show them how their course can be presented to potential employers.

There is no work place learning, if external partners were willing to provide topics for the extended projects this could be viable, otherwise there would be no space in the schedule for this.

No explicit mention of equal opportunities was made, other than the standard provision for any student with a support statement or other specific needs. This course seems suitable for all people with protected characteristics, but the actual student cohort and teaching staff should be evaluated as part of the QA process.

2.b. For collaborative programmes only

- Is there a clear rationale for developing this collaborative arrangement in the proposed way?
- If any academic credit is to be recognised from / by the partner institution, is the credit structure of all awards clear and appropriate?
- Is there an appropriate balance of content between each partner?
- Are the academic and administrative responsibilities of each partner clear and appropriate?

I did not complete this section as I believe it refers to external partners, not courses spanning more than one school or department.

2. Learning, teaching and assessment strategies

- Is there a clear and workable learning and teaching strategy?
- Is there a clear and workable assessment strategy?
- Do the teaching, learning and assessment methods allow students to demonstrate their achievement of the aims and learning outcomes?
- Is there an appropriate range of assessment methods used?
- Do the proposed assessment methods suitably evaluate the attainment of the intended learning outcomes?

The programme has a good teaching strategy with initial taught modules building to an extended project which should prepare the students for the more independent research. The assessment strategy will allow the summative evaluation of the students progress through-out the course.

The module outline says “No previous knowledge of coding and machine learning is assumed.”, which does mean a significant amount of time should be devoted to the give student’s familiarity with the level of python coding required. The MTH766P Programming in Python (15 credits) should be made compulsory for any student who is not already familiar with scientific programming in python, without it
the other ML modules and project will be significantly harder for some students. This should be part of
the induction process to ensure students take the optional modules they would need to get the most out
of the course.

The inclusion of level 7 maths modules in the first and second semesters could be quite difficult for many
students who have not taken at least undergraduate maths modules in the previous 5 years. Again, as
part of the induction process, advice about an online course to refresh their maths knowledge prior to
starting the course may be beneficial to many students.

There is a pattern of setting exams for 50% of the marks, with workshops and reports for the remainder.
This can work well for the proposed new modules, as there are learning outcomes that can be tested in
an exam setting. However, using 100% resit exams would not cover the learning outcomes that are hard
to demonstrate in an exam setting. I understand work is ongoing to adapt the resit opportunities, which
would address this concern.

3. External reference points
   - Has reference been made to Benchmark Statements where applicable?
   - Has reference been made to Framework for Higher Education Qualifications (FHEQ)?
   - Does every award in the programme meet the expectations of the FHEQ?
   - Has reference been made to any relevant Professional and Statutory Regulatory Bodies (PSRBs)?
   - Has reference been made to the Southern England Consortium for Credit Accumulation and Transfer
     (SEEC) credit level descriptors?

The Computing QAA benchmark was listed in the box on the form, however it was not used elsewhere to
demonstrate if the course met the benchmarks. The fact that all modules are drawn from the School of
Physics and Chemistry and also the Maths department means it is not clear if the benchmark is reached
or if this is correct QAA document to use. The postgraduate benchmark standards do seem to be met,
when scanning the list (I did not check each in detail).

However, part of the March 2022 QAA Computing document³, brings in sustainability as a course
requirement. To quote a specific paragraph from the document:

1.15 Computing courses should address the sustainable development
agenda through highlighting key economic, social and environmental
issues that the discipline influences, whether positively or
negatively. Courses should enable students to develop core personal and
professional competencies to address the key societal challenges
highlighted by the United Nations Sustainable Development Goals for
2030 in their future working lives. The Education for Sustainable
Development Guidance (QAA and Advance HE, 2021) outlines pedagogic
approaches for implementation in UK higher education institutions.

This topic not addressed explicitly in this course, adding a learning outcome or skill to a compulsory
module to address this may be required.

The levels of modules have been defined in terms of FHEQ (all level 7).

The PG Cert and PG Dip are not specified other than as interim awards. The number of passed credits will
be defined by QMUL ordinances, however would a student be able to start their third semester project if
they have sat but failed all or most of the 1st and 2nd semester modules? I assume there is a standard
process at QMUL to manage failing MSc students, that should be referenced here, even if only as a link

to the relevant ordinances and/or codes of practice.

No professional standards or other bodies are mentioned.

I have never heard of the SEEC and these documents makes no reference to it.

### 4. Admission, progression and achievement

- Are the entry requirements appropriate and clearly identified?
- Are clear arrangements in place for the induction of new students?
- Are there details for any special educational needs requirements?

The entry requirements (2:1 in STEM or engineering or 2:2 if other evidence of suitability is available), seem clear and reasonable. All postgraduate courses require some flexibility in their requirements. Although as I noted above about Maths provision a student who graduated more than 5 years ago may well struggle with the Maths aspects of the course. They can be accepted on the course, but offered advice about how to prepare for the course in the period between accepting the offer and the start of teaching. Similarly while the python coding module may assume no coding, some preparation studies may serve students worried about their lack of coding background well.

There was no mentioned made about induction. As mentioned above students without a familiarity with scientific python or recent maths experience should be given support to get up to speed. This is especially true for part time students who can only take MTH766P Programming in Python in their second year. A self-assessment should be offered to potential students so they can be advised about which options are suitable and if a refresher on certain topics would be useful well before they start.

The standard text for special educational needs was included. This describes the normal excellent provision expected from a UK university.

### 5. Learning resources and facilities

- Have indicative reading lists been supplied and are they appropriate?
- Have any future resources requirements been clearly articulated?
- Has the use of QMPlus (the QM Virtual Learning Environment (VLE)) been clearly articulated?
- Is there use of distance or blended learning? If so, is this appropriately supported?
- Are their details of and arrangements with placement providers where relevant?

There were reading lists, they all seem recent works and appropriate to the subjects.

I did not see any requests for future resources.

QMPlus was listed as used in the accessibility and plagiarism sections.

There was no discussion about distance learning. For blended learning, the accessibility and inclusivity section mentions that the default will be a flipped classroom teaching model, however this was not detailed enough to understand which modules this applies to. After the existing modules already flipped or only the new ones? Does this apply to modules delivered as seminars with Q&A? The text looks like it was pasted from a standard template, more detail would be welcome.

No placements are required or foreseen for the course.

I also noted that a minimum of 15 students was set for each, with a maximum of 200. It would be nice to see the rational for this. I would assume 200 students would cause logistical problems with booking computing rooms large enough without significant double (or triple) teaching and is a minimum of 15 a QMUL requirement? If not then while it can be inefficient running with fewer students, at least in the first years, may be better than removing optional module choices students expected to take.
### 6. Student guidance and support
- Are there clear arrangements in place for supporting students with specific learning requirements?
- Are there suitable arrangements for dealing with academic misconduct?
- Are there workable academic support arrangements at school and institution level?
- Are there administrative arrangements for student support?

The standard text for special educational needs was included. This describes the normal excellent provision expected from a UK university, I assume the exiting school of Physics and Chemistry methods will apply and are already operating well. The SSO was mentioned as already operating and academic advisors will be assigned to all students, as well as project supervisors for the 3rd semester.

### Quality management and enhancement
- Are appropriate arrangements in place for programme management?
- Are clear quality assurance measures in place?
- For joint programmes, are the responsibilities of all contributing schools / institutes clearly articulated?
- Are details of continued currency and viability of the programme included?
- Are effective mechanisms in place for capturing and utilising the student voice?

The normal QA processes for courses at QMUL will be followed, including asking for and acting on anonymous feedback from the students. There are also student-staff liaison committees in operation. It was not clear if there is a single one covering all UG, PGT and PGR courses; or if there are separate ones for postgraduate courses. A specific PGT SSLC would be of more use as it would address issues specific to the PGT cohorts and encourage attendance if the discussion were more focused.

The normal new course review and ongoing reviews of courses should ensure the course’s ongoing relevance.

### Other
- Please use this space to provide any additional feedback not covered in other sections.

I have answered the specific questions posed in this form, and as such have made several comments where things may be improved. I should note that not with-standing the points above I am firmly in favour of approving this course and it should both fulfil a need of potential students to gain these skills and is well within the skill set of the team at QMUL to deliver it.

---

### For QMUL use only

### 7. Response to External Adviser feedback
- Please include a full response to the comments provided by the External Adviser. Each point / issue raised by the External Adviser that requires further consideration should be addressed in detail in this response.
- QAA Subject Benchmark Statements (http://www.qaa.ac.uk/assuring-standards-and-quality/the-quality-code/subject-benchmark-statements)
Module Proposal Form (PG)

Sections 1 and 2 must be completed in full.
Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b)

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Al in Astrophysics and Space Science
Module code: SPC722P
Credit value: 15
Level: 7
Module type: LSR
Scheme: Taught Postgraduate
Start date: September 2024
Proposed HECoS Code: 100359 artificial intelligence

Further details on HECoS codes can be found here

Responsible School / Institute: School of Physical and Chemical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>X School of Physical and Chemical Sciences</td>
<td>100</td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

N/A

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Physical and Chemical Sciences</td>
<td>Physics and Astronomy (PGT)</td>
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### Anticipated Student Registrations

<table>
<thead>
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<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
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<tr>
<td>2025/26</td>
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</tr>
<tr>
<td>2026/27</td>
<td>50</td>
<td>20</td>
<td>200</td>
</tr>
</tbody>
</table>

### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is an option module for the Artificial Intelligence and Machine Learning in Science PGT programme that will take a cohort of students from a broad set of backgrounds, from both the home and overseas markets. This option will allow students to apply their understanding of data science and AI methods to problem domains found within the field of astrophysics and space science. The purpose of the module is to help students develop a more thorough understanding of methods and translate theory and introductory examples into an applied realm, gaining a deeper understanding of data preparation and approaches to AI and ML analysis in this domain and to develop a better pedagogical understanding of the application of AI and ML prior to embarking on the independent project work in Semester C. Along with the spirit of this data-centric PGT programme, this module will exploit various datasets (e.g. space weather data, planet classification, plasma physics) to explore the traditional analysis methods, the application of standard ML models and the knowledge-based model building.

### Resource Requirements

<table>
<thead>
<tr>
<th>By School / Institute responsible for module:</th>
<th>SPCS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standard teaching rooms and online platforms. Computer labs with appropriate software installed such as JupyterLab + Python 3 + relevant libraries (RDKit, OpenBabel, sklear, Keras, TensorFlow, Pandas and libraries for data visualisation); access to gpu servers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>By any other School / Institute or collaborating institution:</th>
</tr>
</thead>
</table>

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

[Signature of Head(s) of School / Institute]

Head(s) of supporting School / Institute

[Signature of Head(s) of supporting School / Institute]
Section 2 - Module Specification

Module title: Al in Astrophysics and Space Science
Module code: SPC722P

Credit value: 15  Level: 7  Mode of Delivery: On Campus  Semester: Semester 2

Module Organiser: Enrico Camporeale

<table>
<thead>
<tr>
<th>Pre-requisite modules</th>
<th>Co-requisite modules</th>
<th>Overlapping modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

The AI in Astrophysics and Space Science module is designed to help you understand how artificial intelligence and machine learning can be applied to the astrophysics and space-science domains and help you attain a deeper understanding of ML methods applied to real scientific datasets to refine your practical skills and to help prepare for your independent study research project irrespective of the specific problem domain of that. In this module you will learn about data preparation and pathologies related to the use of artificial intelligence and machine learning, you will apply the methods you have studied in your other AI and ML and your Deep Learning modules, and you will explore knowledge-guided machine learning.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

This module aims to enhance a student’s ability to apply AI and ML to data in a scientific context that may or may not be familiar. Students will learn about real research problems in astrophysics and space science that can benefit from the application of AI and ML, and in doing so, build a synoptic understanding of the workflow required to apply modern data science to a scientific problem domain.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

<table>
<thead>
<tr>
<th>Academic Content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
</tr>
<tr>
<td>A2</td>
</tr>
<tr>
<td>A3</td>
</tr>
</tbody>
</table>
4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.


5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.
1. **Student / lecturer interaction**

Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.

This module will consist of lectures and tutorials (3 hrs per week total) over a 12 week period.

2. **Student independent learning time**

Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

Students will be expected to undertake independent study totaling 114 hours.

1. + 2. **Total module notional study hours**

Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

Total time for the student (taught and self study) is 150 hours.

6) **Assessment Profile**

Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Portfolio</td>
<td>Coursework (CWK)</td>
<td>Duration of the module</td>
<td>25</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Report</td>
<td>Coursework (CWK)</td>
<td>2000 words</td>
<td>25</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Exam</td>
<td>Examination (EXM)</td>
<td>2.5 hours</td>
<td>50</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Final element of assessment:** The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark:** A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

**Reassessment**

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)
<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Report</td>
<td>Coursework (CWK)</td>
<td>2000</td>
<td>40</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Exam</td>
<td>Examination (EXM)</td>
<td>2.5 hours</td>
<td>60</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Section 3 - Alternative Assessment Arrangements for Associate Students

This section **must only** be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)
Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Cloud Computing in AI
Module code: SPC724P
Credit value: 15
Level: 7
Module type: LSR
Scheme: Taught Postgraduate
Start date: September 2024
Proposed HECoS Code: 100359 artificial intelligence

Further details on HECoS codes can be found here

Responsible School / Institute: School of Physical and Chemical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Physical and Chemical Sciences</td>
<td>100</td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:
N/A

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Physical and Chemical Sciences</td>
<td>Physics and Astronomy (PGT)</td>
</tr>
</tbody>
</table>
### Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024/25</td>
<td>25</td>
<td>20</td>
<td>200</td>
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<tr>
<td>2025/26</td>
<td>40</td>
<td>20</td>
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</tr>
<tr>
<td>2026/27</td>
<td>50</td>
<td>20</td>
<td>200</td>
</tr>
</tbody>
</table>

### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is an optional module for the Artificial Intelligence and Machine Learning in Science PGT programme that will take a cohort of students from a broad set of backgrounds, from both the home and overseas markets. This optional module will allow students to explore and familiarise themselves with the latest cloud computing and decentralised applications technologies. This module will establish working knowledge of the fundamentals of data management elements including relational taxonomy of data, data lifecycle and fundamentals databases and data processing. The module will then explore network concepts, types of devices and data center functions. Students will learn about services provided on the top “Big Clouds” like computing and hosting services, storage services, networking services, big data services, and machine/deep learning services and they will practice on how to combine these services to support AI analyses and modelling.

### Resource Requirements

**By School / Institute responsible for module:**

- **SPCS**
  - Standard teaching rooms and online platforms. Computer labs with appropriate software installed such as JupyterLab + Python 3 + relevant libraries (RDKit, OpenBabel, sklearn, Keras, TensorFlow, Pandas and libraries for data visualisation); access to gpu servers.

**By any other School / Institute or collaborating institution:**

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

Adrian Bevan

Digitally signed by
Adrian Bevan
Date: 2023.05.21
19:14:25 +0100

**Head(s) of supporting School / Institute**

**Head(s) of supporting School / Institute**

**Head(s) of supporting School / Institute**
Section 2 - Module Specification

Module title: Cloud Computing in AI
Module code: SPC724P
Credit value: 15
Level: 7
Mode of Delivery: On Campus
Semester: Semester 2
Module Organiser: TBD

Pre-requisite modules

Co-requisite modules

Overlapping modules

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

The Cloud computing in AI module is designed to familiarise yourself with the latest Cloud computing and decentralised applications technologies in the context of data management and AI and ML applications. This module will allow you to build working knowledge of the fundamentals of data management and data processing and then to explore network concepts, types of devices and data center functions. You will learn about services provided on the top “Big Clouds” and practice on how to combine these services to support AI analyses and modelling. You will acquire confidence in applying all the tools learned in your master programme to the widest range of computing and business environments.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

This module aims to enhance students' ability to apply AI and ML to data in the widest range of environments. Students will acquire working knowledge about Cloud computing by learning about generic principle of data management in decentralised systems and by applying AI and ML in such environments. This will greatly boost their employability extending the applicability of their coding and AI/ML skills.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

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<td>A3</td>
</tr>
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</table>
Disciplinary Skills - able to:

<table>
<thead>
<tr>
<th>B1</th>
<th>Appreciate the concepts underlying data and database management</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2</td>
<td>Interface with the main services available on Cloud computing</td>
</tr>
<tr>
<td>B3</td>
<td>Apply AI and ML methods in a decentralised environment</td>
</tr>
<tr>
<td>B4</td>
<td>Critically assess suitability of designs and methods in data management and analysis</td>
</tr>
</tbody>
</table>

Attributes:

<table>
<thead>
<tr>
<th>C1</th>
<th>Students should be able to understand basic design concepts guiding data and database management</th>
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</thead>
<tbody>
<tr>
<td>C2</td>
<td>Students should be able to understand basic concepts of Cloud computing</td>
</tr>
<tr>
<td>C3</td>
<td>Students should be able to assess the level of services available from Cloud providers</td>
</tr>
<tr>
<td>C4</td>
<td>Students should be able to interface with decentralised environments and services</td>
</tr>
<tr>
<td>C5</td>
<td>Students should be able to critically assess feasibility and applicability of services to various environments and tasks</td>
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4) Reading List
Please provide an indicative reading list for the module. This should include key texts and/or journals but should not be an exhaustive list of materials.


5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

1. Student / lecturer interaction

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This module will consist of lectures and tutorials (3 hrs per week total) over a 12 week period
2. Student independent learning time

Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

| Students will be expected to undertake independent study totaling 114 hours |

1. + 2. Total module notional study hours

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6) Assessment Profile

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Reassessment

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

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Section 3 - Alternative Assessment Arrangements for Associate Students

This section **must only** be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in **Semester A**. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in **Semester B**. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

### Section 1 - Summary Information

<table>
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<tr>
<th>Module title:</th>
<th>ML for Materials Discovery</th>
<th>Module code:</th>
<th>SPC723P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit value:</td>
<td>15</td>
<td>Level:</td>
<td>7</td>
</tr>
<tr>
<td>Module type:</td>
<td>LSR</td>
<td>Scheme:</td>
<td>Taught Postgraduate</td>
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<tr>
<td>Start date:</td>
<td>September 2024</td>
<td>Proposed HECos Code:</td>
<td>100359 artificial intelligence</td>
</tr>
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Further details on HECos codes can be found [here](#).

**Responsible School / Institute:** School of Physical and Chemical Sciences

<table>
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<tr>
<th>School / Institute</th>
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Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

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<th>Year of Registration</th>
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## Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is an option module for the Artificial Intelligence and Machine Learning in Science PGT programme that will take a cohort of students from a broad set of backgrounds, from both the home and overseas markets. This module will teach students how to use computational methods and machine learning to design new materials. Students will learn to apply artificial intelligence and machine learning models to modern chemical informatics, and how these technologies can be used to model and predict the properties of new materials. The module will expand the students’ experience in understanding and reflecting on use and appropriateness of AI and ML in a research environment they might not be familiar with and students will have the opportunity to apply these techniques to specific cutting edge examples.

## Resource Requirements

**By School / Institute responsible for module:**

SPCS

- Standard teaching rooms and online platforms. Computer labs with appropriate software installed such as JupyterLab + Python 3 + relevant libraries (RDKit, OpenBabel, sklear, Keras, TensorFlow, Pandas and libraries for data visualisation); access to gpu servers.

**By any other School / Institute or collaborating institution:**

## Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

[Digitally signed by Adrian Bevan, Date: 2023.05.21 19:14:25 +0100]

**Head(s) of supporting School / Institute**

**Head(s) of supporting School / Institute**
Section 2 - Module Specification

Module title: ML for Materials Discovery
Module code: SPC723P
Credit value: 15
Level: 7
Mode of Delivery:
Semester: Semester 2
Module Organiser: Devis Di Tommaso

Pre-requisite modules
Co-requisite modules
Overlapping modules

none

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

The ML in Materials Discovery module is designed to help you understand how artificial intelligence and machine learning can be applied to the domain of materials science for materials discovery and help you attain a deeper understanding of ML methods applied to real scientific datasets to refine your practical skills. In this module you will learn the basics of modern chemical informatics, and how AI and ML methods can be exploited to study material properties. Then you will apply these computational methods to design new materials, and to model and predict their properties. You will have the opportunity to apply these techniques to specific cutting-edge examples.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

This module aims to enhance a student’s ability to apply AI and ML to data in a scientific context that may or may not be familiar. Students will learn about real research problems in materials science that can benefit from the application of AI and ML, and in doing so, build a synoptic understanding of the workflow required to apply modern data science to a scientific problem domain.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

A1 Acquire knowledge of the basic concepts and problems in materials science for material characterisation
A2 Prepare data in order to apply one or more machine learning algorithms to address scientific problems in the materials science domain
A3 Apply AI and ML methods to scientific domain context problems in materials science for material design and discovery
### Disciplinary Skills - able to:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B1</strong></td>
<td><strong>Access, clean, and use chemical data.</strong></td>
</tr>
<tr>
<td><strong>B2</strong></td>
<td><strong>Represent molecules in a computer-readable format.</strong></td>
</tr>
<tr>
<td><strong>B3</strong></td>
<td><strong>Calculate molecular descriptors to characterise molecules.</strong></td>
</tr>
<tr>
<td><strong>B4</strong></td>
<td><strong>Prepare data for input to AI and ML models</strong></td>
</tr>
<tr>
<td><strong>B5</strong></td>
<td><strong>Build AI and ML models from given datasets</strong></td>
</tr>
<tr>
<td><strong>B6</strong></td>
<td><strong>Train AI and ML models</strong></td>
</tr>
<tr>
<td><strong>B7</strong></td>
<td><strong>Build and use different modelling systems.</strong></td>
</tr>
</tbody>
</table>

### Attributes:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C1</strong></td>
<td><strong>Students should be able to develop appropriate statistical and machine learning models to analyse data.</strong></td>
</tr>
<tr>
<td><strong>C2</strong></td>
<td><strong>Students should be able to interpret the results of training AI and ML models to understand if these are good or bad outputs.</strong></td>
</tr>
<tr>
<td><strong>C3</strong></td>
<td><strong>Students should be able to critically assess the output of training to understand if the model learned is robust and usable.</strong></td>
</tr>
<tr>
<td><strong>C4</strong></td>
<td><strong>Students should be able to actively question their results to understand where there may be room for improvement.</strong></td>
</tr>
<tr>
<td><strong>C5</strong></td>
<td><strong>Students should be able to compare the outputs of different models.</strong></td>
</tr>
<tr>
<td><strong>C6</strong></td>
<td><strong>Students should be self aware and able to reflect on their gaps in knowledge.</strong></td>
</tr>
</tbody>
</table>

### 4) Reading List

Please provide an indicative reading list for the module. This should include key texts and journals but **should not** be an exhaustive list of materials.

“Machine Learning in Chemistry”, Jon Paul Janet and Heather J. Kulik, May 29, 2020 DOI:10.1021/acs.infocus.7e4001

### 5) Teaching and Learning Profile

Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.
1. **Student / lecturer interaction**

Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc., used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.

| This module will consist of lectures and tutorials (3 hrs per week total) over a 12 week period |

2. **Student independent learning time**

Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

| Students will be expected to undertake independent study totaling 114 hours |

1. + 2. **Total module notional study hours**

Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

| Total time for the student (taught and self study) is 150 hours |

6) **Assessment Profile**

Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Assessed Computational Laboratory</td>
<td>Coursework (CWK)</td>
<td>Duration of the module</td>
<td>50</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Exam</td>
<td>Examination (EXM)</td>
<td>2.5</td>
<td>50</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Final element of assessment:** The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark:** A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

**Reassessment**

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details).

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
</table>
Section 3 - Alternative Assessment Arrangements for Associate Students

This section **must only** be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in **Semester A**. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in **Semester B**. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Research Methods  Module code: SPC721P
Credit value: 15  Level: 7  Module type: LSR  Scheme: Taught Postgraduate
Start date: September 2024
Proposed HECoS Code: 100359 artificial intelligence

Further details on HECoS codes can be found here

Responsible School / Institute: School of Physical and Chemical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>X School of Physical and Chemical Sciences</td>
<td>100</td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

N/A

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Physical and Chemical Sciences</td>
<td>Physics and Astronomy (PGT)</td>
</tr>
</tbody>
</table>
## Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024/25</td>
<td>50</td>
<td>40</td>
<td>200</td>
</tr>
<tr>
<td>2025/26</td>
<td>75</td>
<td>40</td>
<td>200</td>
</tr>
<tr>
<td>2026/27</td>
<td>100</td>
<td>40</td>
<td>200</td>
</tr>
</tbody>
</table>

## Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This is a compulsory module for the AI and ML in Science PGT programme which will take a cohort of students from a broad set of backgrounds, from both the home and overseas markets. It is essential to manage expectations, and provide the students with a foundation on which to build in order to appropriately perform in their research projects for the MSc programme. This module will provide that preparatory background. This includes helping students develop core skills such as ability to communicate in various forms, both written and oral, literature reviews, and the ability to understand data science methods from multiple research domains to help develop a deeper appreciation of examples, advantages, and limitations of methods.

The module is designed to enable team building across the cohort to provide students with an identity and sense of belonging while learning technical and communication skills that are required for their project and employment thereafter.

## Resource Requirements

**By School / Institute responsible for module:**

- **SPCS**
  - Standard teaching rooms and online platforms. Computer labs with appropriate software installed such as JupyterLab + Python 3 + relevant libraries (RDKit, OpenBabel, sklear, Keras, TensorFlow, Pandas and libraries for data visualisation); access to gpu servers; presentation and video tools.

**By any other School / Institute or collaborating institution:**

## Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

<table>
<thead>
<tr>
<th>Head(s) of School / Institute</th>
<th>Adrian Bevan</th>
<th>Date: 2023.05.21 19:14:25 +0100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head(s) of supporting School / Institute</td>
<td>[Signature]</td>
<td>[Signature]</td>
</tr>
</tbody>
</table>
Section 2 - Module Specification

Module title: Research Methods  
Module code: SPC721P

Credit value: 15  
Level: 7  
Mode of Delivery: On Campus  
Semester: Semester 1

Module Organiser: Adrian Bevan

<table>
<thead>
<tr>
<th>Pre-requisite modules</th>
<th>Co-requisite modules</th>
<th>Overlapping modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

The research methods module is designed to help you attain the relevant skills to assess, understand, and visualise data and to undertake your research project. This includes essential skills such as communication and organising information from the literature, through to being able to extract information on data science methods from a multidisciplinary environment and report writing. A strong emphasis will be placed on enabling you to engage with complex information from seminars and to discuss that information to explore how it relates to material studied on your programme. Discussion sessions will be a key part in helping you develop as a data scientist and enhance transferable skills that will benefit you in the rest of your degree and future employment.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

This module aims to enhance a student's ability to communicate via written and oral means. Including abstract, executive summary and report writing as examples of the written form. Oral communication will be enhanced via discussion sessions and seminar Q&A sessions, where it is expected that the students will actively engage in asking questions to better understand seminar contributions from a wide range of talks. Students will also have the opportunity to demonstrate oral communication competency by creating short videos to explain concepts thus demonstrating capability to engage with technology. Students will learn how to process a range of sources including articles in the literature to find, sort and extract relevant information.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

<table>
<thead>
<tr>
<th>Academic Content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
</tr>
<tr>
<td>A2</td>
</tr>
<tr>
<td>A3</td>
</tr>
</tbody>
</table>
Disciplinary Skills - able to:

<table>
<thead>
<tr>
<th>B1</th>
<th>Work in a multidisciplinary context and interpret information from a variety of domain sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2</td>
<td>Communicate with peers through a variety of means, including written and oral means</td>
</tr>
<tr>
<td>B3</td>
<td>Able to process complex information and archive from various sources, predominantly literature, in an ordered and organised way</td>
</tr>
<tr>
<td>B4</td>
<td>Comprehend the rationale for using different statistical methods for different problems</td>
</tr>
</tbody>
</table>

Attributes:

<table>
<thead>
<tr>
<th>C1</th>
<th>Students should be able to communicate clearly in written form using a scientific style.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>Students should be able to engage in scientific discussion, questioning their understanding and be confident to explore complex content as part of a learning journey</td>
</tr>
<tr>
<td>C3</td>
<td>Students should be able to communicate scientific concepts clearly via video recordings</td>
</tr>
<tr>
<td>C4</td>
<td>Students should be able to interpret information from a wide range of end use applications and through this develop an ability to work in a multi-disciplinary environment</td>
</tr>
<tr>
<td>C5</td>
<td>Students should be able to critically assess problems in order to understand how to apply AI and ML to solve them</td>
</tr>
<tr>
<td>C6</td>
<td>Students should be able to actively question information as it is presented to them</td>
</tr>
<tr>
<td>C7</td>
<td>Students should be able to engage in critical discussion</td>
</tr>
<tr>
<td>C8</td>
<td>Students should be self aware and able to reflect on their gaps in knowledge</td>
</tr>
</tbody>
</table>

4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.

This module will not have a core reading list.

There will be a seminar series presenting AI and machine learning methods used in a given domain context. The students will explore the topics presented and develop a range of technical skills and abilities to help communicate what they have understood about the topic. The reading list required for students will be tailored to a relevant area the students choose to explore and they will be expected to find information published in the literature and in books or use relevant online sources (including mainstream media where appropriate).

5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.
1. Student / lecturer interaction

Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.

This will be a seminar led module, where each seminar will have a short Q&A session. Each seminar will be followed by a dedicated discussion session where students will be able to explore the seminar topic. Total time: 2hrs per week, 24 hrs over Sem A

2. Student independent learning time

Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

Students will be expected to undertake independent study totaling 126 hours

1. + 2 Total module notional study hours

Specify the total module notional study hours. This should be a total of the hours given in 1, and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

Total time for the student (taught and self study) is 150 hours

6) Assessment Profile

Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Portfolio</td>
<td>Coursework (CWK)</td>
<td>Duration of the module</td>
<td>40</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Report</td>
<td>Coursework (CWK)</td>
<td>2000 words</td>
<td>30</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Presentation (video)</td>
<td>Coursework (CWK)</td>
<td>10 min</td>
<td>30</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

Final element of assessment: The assessment that takes place last. There should be only ONE element of assessment marked as final.

Qualifying mark: A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

Reassessment

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)
<table>
<thead>
<tr>
<th>Sequence</th>
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<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Report</td>
<td>Coursework (CWK)</td>
<td>2000 words</td>
<td>50</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Presentation</td>
<td>Coursework (CWK)</td>
<td>10 min</td>
<td>50</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

**Section 3 - Alternative Assessment Arrangements for Associate Students**

This section must only be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

**Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)**

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

**Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)**

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Research Project in Data Science
Module code: SPC720P
Credit value: 60
Level: 7
Module type: DPM
Scheme: Taught Postgraduate
Start date: September 2024

Proposed HECoS Code: 100359 artificial intelligence

Further details on HECoS codes can be found here

Responsible School / Institute: School of Physical and Chemical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>X School of Physical and Chemical Sciences</td>
<td>100</td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

N/A

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Physical and Chemical Sciences</td>
<td>Physics and Astronomy (PGT)</td>
</tr>
</tbody>
</table>
### Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024/25</td>
<td>50</td>
<td>40</td>
<td>200</td>
</tr>
<tr>
<td>2025/26</td>
<td>75</td>
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<td>200</td>
</tr>
<tr>
<td>2026/27</td>
<td>100</td>
<td>40</td>
<td>200</td>
</tr>
</tbody>
</table>

### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the **status of the module on each** should also be made clear.

This is a core module of the MSc programme Artificial Intelligence and Machine Learning in Science. Completing an independent project is an essential component in the training of postgraduate students and their preparation for work after graduation. The module will provide the means for students to apply what learned in their taught modules and implement it in a research or applied project in Artificial Intelligence and Machine Learning in a variety of research topics. Students will be guided by the researchers of the School of Physical and Chemical Sciences and the School of Mathematical Sciences and will be able to work on cutting-edge problems and datasets in the fields of Astrophysics, Cosmology, Space Science, Chemistry, Condensed Matter, Environmental Studies, Materials Science, Mathematics, Particle Physics and more. The module will develop independence and solidify core and transferable skills and depth of knowledge, in particular, mastery of data analysis, model building, result communication and scientific writing.

### Resource Requirements

**By School / Institute responsible for module:**

SPCS
- Standard teaching rooms and online platforms. Computer labs with appropriate software installed such as JupyterLab + Python 3 + relevant libraries (RDKit, OpenBabel, sklearn, Keras, TensorFlow, DeepChem, Pandas and libraries for data visualisation); access to gpu servers.

**By any other School / Institute or collaborating institution:**

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute:**

Adrian Bevan

Digitally signed by Adrian Bevan

Date: 2023.05.21 19:14:25 +01'00'**

**Head(s) of supporting School / Institute**

**Head(s) of supporting School / Institute**
Section 2 - Module Specification

Module title: Research Project in Data Science
Module code: SPC720P
Credit value: 60
Level: 7
Mode of Delivery: On Campus
Semester: Semester 2
Module Organiser: TBC

Pre-requisite modules

Co-requisite modules

Overlapping modules

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

The students work on research topics in one of the areas of Artificial Intelligence and Machine Learning in Science set by their project supervisors. Computational work is the principal component of the projects. The work also involves critical evaluation of previously published results. A dissertation is prepared.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

To develop skills in addressing a particular scientific problem encompassing artificial intelligence, machine learning, data mining or other computational and theoretical approaches.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

A1 Advanced knowledge of methods, theories and concepts relating to the application of Artificial Intelligence and Machine Learning to the specific area of science in which the project is undertaken.

A2 Ability to organise and critically evaluate research data and published scientific information.

A3 Knowledge of conventional styles for presenting scientific data in written reports and oral presentations.
Disciplinary Skills - able to:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B1</strong></td>
<td>Carry out research using skills and tools from artificial intelligence.</td>
</tr>
<tr>
<td><strong>B2</strong></td>
<td>Prepare written scientific reports describing original work in a clear and concise way.</td>
</tr>
<tr>
<td><strong>B3</strong></td>
<td>Give a presentation on original scientific work; discuss own results in a competent way.</td>
</tr>
<tr>
<td><strong>B4</strong></td>
<td>Work independently.</td>
</tr>
<tr>
<td><strong>B5</strong></td>
<td>Select appropriate methods, tools and procedures.</td>
</tr>
</tbody>
</table>

Attributes:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C1</strong></td>
<td>Gain experience and develop skills necessary for independent, original scientific work; develop problem-solving, IT and communication skills; learn how to collect and critically evaluate scientific information.</td>
</tr>
<tr>
<td><strong>C2</strong></td>
<td>Gain experience and learn how to present original scientific results and findings; learn how to organize time and project work.</td>
</tr>
</tbody>
</table>

4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.

The project-specific reading list depends on the specific project and will be provided initially by the supervisor.

Indicative reading list and topics:
- Tailored materials on literature searching using databases; how to give a presentation and poster.

5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
</table>
| **1. Student / lecturer interaction** | Lectures (dissertation writing, oral communication skills, plagiarism and conduct) ~ 8 h  
Induction and project supervision ~ 24h |
| **2. Student independent learning time** | Project work and dissertation writing ~ 568 h |
1. + 2. Total module notional study hours

Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours. Total time for the student (taught and self-study) is 600 hours.

6) Assessment Profile

Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dissertation</td>
<td>Dissertation (DIS)</td>
<td>7500 words</td>
<td>50</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Practical work &amp; record</td>
<td>Practical (PRA)</td>
<td>duration of module</td>
<td>20</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Oral assessment &amp; presentation</td>
<td>Practical (PRA)</td>
<td>20 min</td>
<td>30</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Final element of assessment:** The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark:** A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

**Reassessment**

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- ☐ Standard Reassessment
- ☐ Synoptic Reassessment

**Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)**

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
</table>

**Section 3 - Alternative Assessment Arrangements for Associate Students**

This section **must only** be completed if the module will be made available to associate students in Semester A and where the credit value of the “associate” version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.
Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

<table>
<thead>
<tr>
<th>Nature of proposal(s)</th>
<th>Part 2 Programme Proposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owning Institute</td>
<td>School of Mathematical Sciences</td>
</tr>
</tbody>
</table>
| Title of Proposal(s) being considered | MSc Actuarial Science and Data Analytics (FT, Onsite)  
MSc Actuarial Science and Data Analytics (PT, Onsite) |
| Documents included   | • Part 2 Programme Proposal Form  
• External Adviser Feedback Form  
• Programme Specification  
• Module Proposal Forms:  
  o Actuarial Science and Data Analytics Dissertation (Core)  
  o Actuarial Risk Management 1 (Compulsory)  
  o Actuarial Risk Management 2 (Compulsory)  
  o Financial Engineering (elective)  
  o Foundations of Mathematics and Statistics (elective)  
  o Mathematical Tools for Asset and Liability Management (elective)  
  o Survival Models (elective) |
| Outcome requested    | Taught Programmes Board (TPB) is asked to consider and approve the proposal(s) identified above and detailed in the accompanying documentation. If any conditions of approval or recommendations arise from the Board these should be clearly stipulated and articulated to the proposer. |
| Comments and potential issues identified by DGLS | **Background**  
The School wishes to introduce a new postgraduate programme to build on the current success of the IFoA accredited UG programme. The programme is not accredited by the IFoA but certain modules will provide exemption.  
The programme is aimed at those with actuarial science training looking to move beyond their traditional roles and will also appeal to graduates with quantitative backgrounds  

**Programme Structure**  
Students undertake 60 credits of compulsory modules and 60 credits of electives - from a limited pool and a 60-credit dissertation.  

Full time students:  
Sem 1: 60 taught credits, Sem 2: 60 taught credits, and Sem 3: 60 credit dissertation |
Part time students:
Year 1: Sem 1: 30 taught credits Sem 2: 30 taught credits
Year 2: Sem 1: 30 taught credits, Sem 2: 30 taught credits, Sem 3: 60 credit dissertation

Entry Requirements
Good 2.1 in a related field, the School reserves the right to review applicants with a good 2.2.

Modules
The proposal is accompanied by proposals for a programme specific dissertation, three new electives and 2 new compulsory modules.

External Adviser comments
Comments have been sought and are favourable. The external doesn’t raise any issues for the Board to note.

The Board may wish to address the fact that there are still minor discrepancies in the Programme Specification
- Mention of part-time is missing on page 1
- The text in the How is the programme structured? section describes part-time, but the associated table only illustrates full-time diet
Purpose

External Advisers are usually members of academic staff external to Queen Mary, who are asked to comment on proposals for new undergraduate or postgraduate taught programmes in accordance with the above guidelines.

External Advisers should expect to receive and review:
- Part 2 Programme Proposal Form
- Programme Specification
- Module Proposal Forms for any new modules

Scope

External Advisers are asked to provide feedback on each of the areas listed below, in relation to the proposed programme. Please note that this list is not exhaustive, and Advisers are encouraged to comment on any aspect of the proposal; drawing on their own knowledge and experience. As a guide, an external advisor’s report for a standard undergraduate or taught masters programme would normally be in the region of two to four sides of A4.

External Adviser details

<table>
<thead>
<tr>
<th>Name &amp; Title of External Adviser:</th>
<th>Dr. Hirbod Assa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Post &amp; Institution / Organisation:</td>
<td>Senior Lecturer, Kent Business School</td>
</tr>
<tr>
<td>Email address for correspondence:</td>
<td><a href="mailto:h.assa@kent.ac.uk">h.assa@kent.ac.uk</a> (in three weeks I will move to Essex with new email: <a href="mailto:ha23249@essex.ac.uk">ha23249@essex.ac.uk</a> )</td>
</tr>
<tr>
<td>I confirm that I have received and reviewed the documentation listed above:</td>
<td>☑</td>
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</table>

1. **Aims, objectives and learning outcomes**
   - Does the programme have clearly articulated aims and learning outcomes which appear to meet the needs of students and equip them for further study or employment?
   - Do the academic standards in subject content and teaching and learning match the aims and learning outcomes?
   - Are all programme learning outcomes met within modules?
   - Are the learning outcomes and the expectations of students clearly developed throughout the programme?

   The program presentation effectively articulates the objectives and learning outcomes. The proposed innovations align with the contemporary knowledge prerequisites, ensuring that students are adequately equipped for further academic pursuits or employment opportunities. The academic standards are warranted and harmonize with the intended learning outcomes. The proposed MSc programs exhibit excellent design.
and effectively address innovation within the fast-paced financial industry.

2.a. Curriculum, design, content and organisation
- Does the design and content of the curricula support student learning, and the achievement of the intended learning outcomes?
- Does the content and design of the curricula aid progression through the programme?
- Is the specialist content of the programme up to date and comparable with that of similar programmes elsewhere?
- Is the structure of the programme clearly defined and explained?
- Is the credit structure appropriate for a programme of the assigned level?
- Is the student workload appropriately balanced across the academic year?
- Does the programme include appropriate careers education?
- Is consideration given to work-based and placement learning?
- Are professional practice requirements noted where relevant?
- Have equal opportunities been considered in the development?

The programme offers a robust framework in actuarial and data science by supplementing a collection of actuarial and risk-oriented modules with two compulsory modules offered in each term by the school of mathematics.
- The module choices are consistent with the programme's stated objectives and encompass cutting-edge advancements in the field of actuarial and data science. The distribution of modules is satisfactory.
- The programme encompasses an extensive array of content specifically tailored for careers education.

2.b. For collaborative programmes only
- Is there a clear rationale for developing this collaborative arrangement in the proposed way?
- If any academic credit is to be recognised from / by the partner institution, is the credit structure of all awards clear and appropriate?
- Is there an appropriate balance of content between each partner?
- Are the academic and administrative responsibilities of each partner clear and appropriate?

N/A

2. Learning, teaching and assessment strategies
- Is there a clear and workable learning and teaching strategy?
- Is there a clear and workable assessment strategy?
- Do the teaching, learning and assessment methods allow students to demonstrate their achievement of the aims and learning outcomes?
- Is there an appropriate range of assessment methods used?
- Do the proposed assessment methods suitably evaluate the attainment of the intended learning outcomes?

The learning, teaching, and assessment strategies are rational and consistent with other comparable MSc programmes in this field/discipline offered in other universities.

3. External reference points
- Has reference been made to Benchmark Statements where applicable?
- Has reference been made to Framework for Higher Education Qualifications (FHEQ)?
- Does every award in the programme meet the expectations of the FHEQ?
- Has reference been made to any relevant Professional and Statutory Regulatory Bodies (PSRBs)?
- Has reference been made to the Southern England Consortium for Credit Accumulation and Transfer (SEEC) credit level descriptors?

### The programme design is aligned with the FHEQ level for MSc programmes

4. Admission, progression and achievement
   - Are the entry requirements appropriate and clearly identified?
   - Are clear arrangements in place for the induction of new students?
   - Are there details for any special educational needs requirements?

The entry requirements have been explicitly communicated and are suitable. QMUL has incorporated provisions for accommodating special educational needs.

5. Learning resources and facilities
   - Have indicative reading lists been supplied and are they appropriate?
   - Have any future resources requirements been clearly articulated?
   - Has the use of QMPlus (the QM Virtual Learning Environment (VLE)) been clearly articulated?
   - Is there use of distance or blended learning? If so, is this appropriately supported?
   - Are there arrangements with placement providers where relevant?

Reading lists have been provided for the proposed new modules, ensuring comprehensive study materials are available. Additionally, teaching resources such as available hardware and software have been carefully taken into consideration.

6. Student guidance and support
   - Are there clear arrangements in place for supporting students with specific learning requirements?
   - Are there suitable arrangements for dealing with academic misconduct?
   - Are there workable academic support arrangements at school and institution level?
   - Are there administrative arrangements for student support?

- **The Programme specification form explicitly outlines QMUL's provisions for students with special educational needs.**
- The programme specification form includes comprehensive information on the available academic support, as outlined in the section "What academic support is available?"
- The Part 2 form provides detailed information on the implemented measures to detect instances of plagiarism.

7. Quality management and enhancement
   - Are appropriate arrangements in place for programme management?
   - Are clear quality assurance measures in place?
   - For joint programmes, are the responsibilities of all contributing schools / institutes clearly articulated?
   - Are details of continued currency and viability of the programme included?
   - Are effective mechanisms in place for capturing and utilising the student voice?
The programme benefits from the presence of a dedicated programme manager, and internal oversight mechanisms are incorporated into the programme management.

<table>
<thead>
<tr>
<th>8. Other</th>
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<tbody>
<tr>
<td>• Please use this space to provide any additional feedback not covered in other sections.</td>
</tr>
</tbody>
</table>

The program's innovations, especially the introduction of new modules, are well-justified and effectively address the evolving demands for knowledge and skills necessary for further academic pursuits and successful entry into the job market.

For QMUL use only

<table>
<thead>
<tr>
<th>9. Response to External Adviser feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Please include a full response to the comments provided by the External Adviser. Each point / issue raised by the External Adviser that requires further consideration should be addressed in detail in this response.</td>
</tr>
</tbody>
</table>

External reference points

- QAA Subject Benchmark Statements (http://www.qaa.ac.uk/assuring-standards-and-quality/the-quality-code/subject-benchmark-statements)
Part 2 Programme Proposal Form

All sections must be completed in full and supplementary information attached where requested. Part 2 proposals should be submitted with the documentation listed below, to the Academic Secretariat who will arrange for the consideration of the proposal at Taught Programmes Board:

- Programme Specification
- External Adviser Feedback Form(s)
- Module Proposal Forms for any new modules forming part of the proposed programme
- Draft Memorandum of Agreement (for any programme proposals involving a collaborative partner)

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Summary Information

Proposed Programme Title: Actuarial Science and Data Analytics

Proposed Programme and Route Code(s): FT: PSACS-G13B  PT: PSACS-G13F

<table>
<thead>
<tr>
<th>Award</th>
<th>Mode of study</th>
<th>Programme Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master of Science (MSc)</td>
<td>Full-time</td>
<td>1 calendar year</td>
</tr>
<tr>
<td>Master of Science (MSc)</td>
<td>Part-time</td>
<td>2 calendar years</td>
</tr>
</tbody>
</table>

Proposed start date: September 2024

Proposed term dates:

Does this programme contain a foundation year or any pre-sessional activity?  No

Will this programme be available to Science & Engineering Foundation (SEFP) students after completion of the foundation year?  N/A
1) Programme Management
Please describe the arrangements for the operational management of the programme and the quality assurance and enhancement mechanisms that will be put in place. Consideration should be given to student representatives and hearing student views.

Please complete either section a) for programmes delivered by one QMUL School / Institute or section b) for programmes delivered by more than one QMUL School / Institute. Programme management arrangements for collaborative programmes should also be reflected in the Memorandum of Agreement with the partner institution.

a) Single School / Institute Delivery

The programme will be delivered by the School of Mathematical Sciences.

Academic coherence will be ensured through the usual structures and mechanisms within SMS, including consideration and consultation with the Learning and Teaching Committee and inclusion in ongoing Curriculum Review, etc.

Additionally, lecturers, administrators, and the programme director will meet at least once a year to review the programme and discuss potential revisions.

Student feedback will be integrated into all curriculum and programme review activities via the mechanisms already in place within SMS. This will include formal (via questionnaires) and informal student evaluations, feedback given through student representatives, etc. with an annual review to ensure that all feedback is properly considered and actioned.

b) Joint School / Institute Delivery

For programmes that are delivered jointly between more than one QMUL School / Institute or for programmes that utilise modules from other QMUL Schools / Institutes in an interdisciplinary capacity, a separate joint working statement signed by all relevant Heads of Schools / Institutes should also be provided. This should identify the respective responsibilities of each QMUL School / Institute with regards to programme management, quality assurance, enhancement, and student support, and should be reviewed on an annual basis.

N/A
2) Accessibility and inclusivity
Please describe how you have factored in the needs of all students for this programme, including those with disabilities and those who are neurodiverse (e.g. have dyslexia, AD(H)D, autism). Considerations of this nature should include the following:
- Are the learning outcomes for the programme and each module clear?
- Have all reading lists been reviewed in the last academic year with consideration given to texts that are available electronically as well as in hard copy?
- Have all reading lists been included on the Reading Lists Online resource available from Library Services?
- How much of the teaching will be made available via Q-Review and when will recordings be released to students?
- Has consideration been given to using QMPlus to post audio content for students to relisten to?
- Has QMPlus content been checked for accessibility standards with the E-Learning Unit?

Further information and guidance on inclusive practice can be found on the Disability and Dyslexia Service's website.

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:
- Finding out if you have a specific learning difficulty like dyslexia
- Applying for funding through the Disabled Students’ Allowance (DSA)
- Arranging DSA assessments of need
- Special arrangements in examinations
- Accessing loaned equipment (e.g. digital recorders)
- Specialist one-to-one "study skills" tuition
- Ensuring access to course materials in alternative formats (e.g. Braille)
- Providing educational support workers (e.g. note-takers, readers, library assistants)
- Mentoring support for students with mental health issues and conditions on the autistic spectrum.

3) Plagiarism Detection
Consideration should be given to the use of plagiarism detection software e.g. turnitin, for programmes with a significant proportion of written assessed work. Please provide information about how this will be managed for the programme.

A management panel for the programme will be set up. The panel will meet to discuss all submitted MSc projects with a specific point on the agenda to detect plagiarism. MSc project supervisors will be required to check their student projects for evidence of plagiarism. In the case of electronic submissions, "Turnitin" and similar software will be used to automatically identify significant overlap.

4) Academic Staffing for the programme (non-QMUL staff)
Please list any academic staff that are not employed or managed by QMUL that will be involved in the teaching or assessment of the programme. For collaborative programmes, this list should include staff from the partner institution(s) who will be involved in delivering the proposed programme.

N/A
5) Distance Learning Programmes (if applicable)
If the programme is to be delivered via distance learning, please describe the specific arrangements in place to ensure the quality of distance learning provision. Particular consideration should be given to enrolment, assessment, provision of learning materials, and student support. All proposals for new distance learning programmes should be discussed with the e-Learning team.

N/A

6) Subject Examination Board Details
Please specify the name of the Subject Examination Board (SEB), which will oversee the assessment processes that operate for the programme(s) and modules. Clarify whether this is a new or existing SEB. For further information please contact Simon Hayter.

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Mathematical Sciences</td>
<td>Mathematical Sciences (PGT)</td>
</tr>
</tbody>
</table>

The following documents must accompany the Part 2 Programme Proposal. Proposals that are not accompanied by the necessary documentation will not be considered by Taught Programmes Board.

- Has a Programme Specification been completed and submitted with the Part 2? [Yes]
- Have module proposal forms for each new module been submitted with the Part 2? [Yes]
- Has at least one External Adviser Feedback Form been submitted with the Part 2? [Yes]
- If any special regulations are required for the proposed programme, have these been clearly documented and/or appended? [N/A]

Collaborative provision: programmes that are offered in partnership with an external organisation should usually have the following documents appended to the Part 2 Programme Proposal.

- Has a draft Memorandum of Agreement been submitted with the Part 2? [N/A]

Approval of Part 2 Programme Proposal

The signature of the Heads of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).
Once a programme has passed Part 2 approval offers can be made to applicants. For programmes that are offered in partnership with an external organisation, offers cannot be made until the Memorandum of Agreement has been signed. This will be arranged by the Academic Secretariat.
Programme Specification (PG)

Awarding body / institution: Queen Mary University of London
Teaching institution: Queen Mary University of London
Name of final award and title: Actuarial Science and Data Analytics MSc
Name of interim award(s): PG Cert and PG Dip
Duration of study / period of registration: 1 year full time
Queen Mary programme code(s): 
QAA Benchmark Group: Mathematics, Statistics and Operational Research
FHEQ Level of Award: Level 7
Programme accredited by: Institute and Faculty of Actuaries (IFoA)
Date Programme Specification approved: TBC
Responsible School / Institute: School of Mathematical Sciences

Programme outline

The programme is designed to provide students with a large number of accreditations by the Institute and Faculty of Actuaries (IFoA), which are highly valued by employers. No postgraduate programme currently on offer has such a wide coverage for accreditations. The programme includes courses on actuarial risk management, actuarial mathematics, actuarial statistics, machine learning and data analytics. Once accreditations are approved by the IFoA for this programme, students will be able to gain the exemptions automatically for Core Principles (CM2 and CS2) IFoA accreditation and Core Practices (CP1, CP2 and CP3) of the IFoA on completion of the programme.

Students are also trained using statistical software such as Excel/VBA, R and Python to analyse and visualise data. In the Dissertation module, students will work in areas such as general and life insurance, pensions, healthcare, risk and investment depending on the students' interests. Our actuarial training has a perfect mix of theory and professional practice and students will have the opportunity to work on real industry challenges, on occasions directly with an industry partner.

In the first semester, students study two compulsory modules: Actuarial Risk Management 1 and Machine Learning with Python. They also choose two electives from our actuarial science and data analytics courses. Actuarial Risk Management 1 covers fundamental topics such as insurance products, regulatory regimes, investment markets, and risk governance. Students learn risk analysis, scenario analysis, and stochastic modeling. The module also includes rigorous training in Python for machine

Schools / Institutes which will also be involved in teaching part of the programme: 

Collaborative institution(s) / organisation(s) involved in delivering the programme: 

Programme Specification PG / 2021-22/ V1
Programme Title: Actuarial Science and Data Analytics

learning and real-life case analysis.

In the second semester, students study two compulsory modules: Actuarial Risk Management 2 and Time Series for Business. They also choose two electives from our actuarial science and data analytics courses. Actuarial Risk Management 2 focuses on identifying actuarial problems and developing practical solutions. Topics include profitability, reporting results, insolvency, closure, and options and guarantees. Students also learn the actuarial control cycle for financial planning. In Time Series, students analyze historical business data, extract trends and cyclic components, calculate autocorrelation, and study autoregressive and moving average models. Realistic examples and solutions are provided using SAS or Excel/VBA. Elective modules cover financial engineering, asset and liability modeling, advanced machine learning, financial data analytics, neural networks, deep learning, and computational statistics with R.

The summer semester is the culmination of a year of learning, where students participate in field-related projects. The project consists of two parts: modelling and communication. The modelling part focuses on critical analysis and modelling of common actuarial data using analytical and statistical methods, generating innovative outputs while maintaining an audit trail. The communication part emphasizes effective written communication of innovative research and actuarial/financial solutions to both actuarial and non-actuarial audiences. The MSc project prepares students for actuarial work or pursuing a PhD.

Aims of the programme

As the actuarial profession has moved beyond its traditional roles and has expanded into a wide variety of data science roles, the MSc in Actuarial Science and Data Analytics provides a clear offering in line with the evolution of the actuarial profession. The programme will be of interest to students with quantitative backgrounds and aims to equip students with advanced knowledge and practical skills in the field of both actuarial science and data science, i.e., actuarial methods in mathematics and statistics, actuarial risk management, the application of statistical methods and computer programming for providing advanced actuarial solutions.

The programme will provide students with a large number of accreditations by the Institute and Faculty of Actuaries (IFoA) and will give students the knowledge and skills necessary to obtain employment in a wide variety of roles in the field of general or life insurance, pension funds, healthcare, regulatory bodies, or corporations.

The primary aim of this programme is to provide students with a solid foundation in actuarial risk management, actuarial mathematical, actuarial statistics and methodologies, and techniques for data analysis. The students will be encouraged to apply this knowledge to real-world situations. Students will develop a deep understanding of risk management techniques, data analysis, and interpretation, allowing them to extract meaningful insights from large and complex datasets such financial data or mortality and morbidity data.

The programme also focuses on enhancing students’ proficiency in various technologies, such as Excel/VBA, R, Python. Students will gain hands-on experience with cutting-edge software and programming languages, enabling them to effectively manipulate, analyse, and visualize data using real world scenarios in the actuarial practice.

Furthermore, the programme aims to foster critical thinking and problem-solving abilities in students. They will learn to design and execute research projects with a clear applicability in the actuarial profession, formulate questions, and select appropriate methodologies, learn how to provide actuarial and financial solutions, integrate them and monitor them for future financial strategies. Through practical exercises and projects, students will develop the ability to apply techniques to solve real-world challenges.

In addition to academic content, the programme places emphasis on developing essential disciplinary skills and abilities. Students will learn to collaborate effectively in interdisciplinary teams. They will also cultivate strong communication skills, enabling them to present complex concepts and findings to both technical and non-technical audiences in a clear and concise manner.

What will you be expected to achieve?

You will have strong analytical skills needed to perform efficiently and competitively in a variety of actuarial roles. Furthermore, you will be able to gain exemptions for Core Principles and Core Practices subjects of IFoA accreditations which will result in Associate-level accreditation (subject to 2 years' work experience).

You will be able to understand and manage various types of actuarial risks. You will be able to adapt and evolve your data
Programme Title: Actuarial Science and Data Analytics

analytic skills to new challenges in the field both in terms of new and large data available but also constant need for development of financial and actuarial products for a constant and fast changing market for risk. You will also be a successful communicator capable to transmit technical information in a accessible way to non-actuarial audiences.

<table>
<thead>
<tr>
<th>Academic Content:</th>
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<tr>
<th>Disciplinary Skills - able to:</th>
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<tr>
<td>B1</td>
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<td>B2</td>
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<td>B3</td>
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<td>C1</td>
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<td>C2</td>
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<tr>
<td>C3</td>
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<td>C4</td>
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</table>

How will you learn?

In the Actuarial Science and Data Analytics MSc programme, your learning experience will be comprehensive and supported by various methods. Here’s how you will learn:

1. Formal Lessons: You will attend structured formal lessons delivered by experienced lecturers who are experts in their respective fields. These lessons will provide you with the necessary theoretical foundations, concepts, and methodologies in the field. The curriculum is designed to cover a wide range of topics, ensuring a well-rounded understanding of the subject matter.

2. Tutorials: Alongside formal lessons, you will have the opportunity to participate in tutorials. Tutorials offer a smaller group setting where you can engage in interactive discussions, ask questions, and receive further clarification on complex topics. Tutorials provide a supportive environment for deeper exploration of course materials and facilitate peer-to-peer learning.

3. Assignments: Throughout the programme, you will be assigned various coursework and assignments. These assignments will
challenges you to apply the knowledge and techniques learned in the classroom. They will involve hands-on tasks, problem-solving exercises, and applications to real-world datasets.

4. MSc Dissertation Project: As part of your MSc journey, you will undertake a summer dissertation project. This project will be a culmination of your learning, where you will have the opportunity to demonstrate your ability to conduct independent research, apply state-of-the-art methodologies, and generate valuable insights. You will work closely with a supervisor who will guide and support you throughout the project.

5. Access to State-of-the-Art Software and Hardware: The programme ensures that you have access to cutting-edge software and hardware resources. You will have the opportunity to work with industry-standard statistical software packages, programming languages, and data analysis and visualisation tools. Access to advanced hardware and computing resources will enable you to handle large datasets and perform computationally intensive analyses effectively.

6. Personal Academic Advisor: Each student will be assigned a personal academic advisor who will serve as a mentor and guide throughout your academic journey. Your advisor will provide support and advice on course selection, academic progress, and career development. They will assist you in navigating the programme requirements and help you make informed decisions regarding your academic and professional goals.

7. Office Hours: Lecturers and teaching staff will hold regular office hours, during which you can schedule one-on-one meetings to seek clarification, discuss coursework, receive feedback, and address any questions or concerns. Office hours provide an opportunity for personalized interaction, allowing you to receive individualized attention and guidance from faculty members.

Overall, the learning experience in the Actuarial Science and Data Analytics MSc will combine formal lessons, interactive tutorials, practical assignments, independent research, access to advanced technology, and personal support from academic advisors and lecturers. This holistic approach will foster a dynamic and engaging learning environment, enabling you to develop a strong foundation in actuarial science and prepare you for successful careers in this field.

How will you be assessed?

You will be assessed by a combination of in-term class tests (some of which are computer-based) and written examinations. Some modules may also have in-term assessed coursework assignments or projects.

For the in-term class tests and assignments (but excluding those that are the final element of assessment for a module) we generally aim to release provisional marks, and to give detailed feedback, within two weeks.

The MSc dissertation project represents a significant component of your assessment. This independent research project allows you to investigate a specific research question or problem in depth. You will design and execute a research study, analyze data, and present your findings in a formal written dissertation. The dissertation will be assessed based on the quality of research design, data analysis, interpretation, and the clarity and coherence of your written work.

The combination of assignments, exams, projects, and the MSc dissertation ensures a comprehensive evaluation of your knowledge and practical skills in applied statistics and data science.

Throughout the programme, you will receive feedback and guidance from faculty members, allowing you to identify areas of improvement and enhance your learning experience. The assessments are designed not only to evaluate your progress but also to promote active engagement with the subject matter and to prepare you for future challenges.

How is the programme structured?

Please specify the structure of the programme diets for all variants of the programme (e.g. full-time, part-time - if applicable). The description should be sufficiently detailed to fully define the structure of the diet.

The programme consists of four compulsory taught modules (two in Semester A and two in Semester B) and four elective modules (two in Semester A and two in Semester B), as well as a summer dissertation project. Full-time students are expected to complete eight taught modules and the project dissertation in one academic year.

The programme provides a wide range of electives in order to consider the needs of students that already have some knowledge in the field or have already obtained accreditations associated with some of the modules we offer, such as the case of our own BSc in Actuarial Science students.
Programme Title: Actuarial Science and Data Analytics

Students choose their elective modules according to their academic background and interests, in consultation with the Programme Director and other staff as needed. The programme will incorporate a robust advising process to support students in choosing the relevant pathway leading to the desired level of accreditations gained.

NOTE: codes in parenthesis such as “CP1” beside the module name refer to the IFoA accreditation corresponding to that module.

Semester A
- Compulsory:
  NEW [7] Actuarial Risk Management 1 (CP1)
- Electives:
  NEW [7] Survival Models (CS2)
  MTH765P [7] Storing, Manipulating and Visualising Data

Semester B
- Compulsory:
  MTH783P [7] Time Series for Business (CS2)
- Electives:
  MTH792P [7] Financial Data Analytics
  MTH767P [7] Neural Networks and Deep Learning

Semester C:
Core (60 credits)
NEW [7] Actuarial Science and Data Analytics Dissertation (CP2 and CP3)

Note: students with no prior accreditation and QM Students with an undergraduate degree from SMS without the modules that cover CS2 and CM2 can choose the elective modules covering CS2 and CM2. If a student already has accreditations for either CS2 or CM2, or graduated from QM SMS with an undergraduate degree with modules covering CS2 or CM2, their choice of electives on this MSc will exclude CM2 or CS2 modules.

Part Time Diet:

Semester A, Year 1
- Compulsory:
  NEW [7] Actuarial Risk Management 1 (CP1)

Semester B, Year 1
- Compulsory:
  MTH783P [7] Time Series for Business (CS2)

Semester A, Year 2
- Electives (choose 2 from the list below)
  NEW [7] Survival Models (CS2)
  MTH765P [7] Storing, Manipulating and Visualising Data
**Programme Title:** Actuarial Science and Data Analytics

**Semester B, Year 2**
- Electives (choose 2 from the list below)
  - MTH792P [7] Financial Data Analytics
  - MTH767P [7] Neural Networks and Deep Learning

**Semester C, Year 2**
- Core (60 credits)
  - NEW [7] Actuarial Science and Data Analytics Dissertation (CP2 and CP3)

### Academic Year of Study

<table>
<thead>
<tr>
<th>Module Title</th>
<th>Module Code</th>
<th>Credits</th>
<th>Level</th>
<th>Module Selection Status</th>
<th>Academic Year of Study</th>
<th>Semester</th>
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<tbody>
<tr>
<td></td>
<td>NEW</td>
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</table>
Programme Title: Actuarial Science and Data Analytics

<table>
<thead>
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<th>Module Selection Status</th>
<th>Academic Year of Study</th>
<th>Semester</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>MTH791P</td>
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<td>7</td>
<td>Elective</td>
<td>1</td>
<td>Semester 2</td>
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<td>7</td>
<td>Elective</td>
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<td>Semester 2</td>
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<tr>
<td></td>
<td>NEW</td>
<td>60</td>
<td>7</td>
<td>Core</td>
<td>1</td>
<td>Semester 3</td>
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</table>

What are the entry requirements?
An upper second BSc degree in actuarial science, mathematics, statistics, econometrics, mathematical economics, finance, or engineering. Students with a good lower second class degree may be considered on an individual basis. Applicants with unrelated degrees will be considered if there is evidence of equivalent content in their academic or professional background. For international students we require English language qualifications IELTS 6.5.

How will the quality of the programme be managed and enhanced? How do we listen to and act on your feedback?
The Staff-Student Liaison Committee provides a formal means of communication and discussion between Schools and its students. The committee consists of student representatives from each year in the school/institute together with appropriate representation from staff within the school/institute. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Staff-Student Liaison Committees meet regularly throughout the year.

Each school operates a Learning and Teaching Committee, or equivalent, which advises the School/Institute Director of Taught Programmes on all matters relating to the delivery of taught programmes at school level including monitoring the application of relevant QM policies and reviewing all proposals for module and programme approval and amendment before submission to Taught Programmes Board. Student views are incorporated in this Committee’s work in a number of ways, such as through student membership, or consideration of student surveys.

What academic support is available?
All students will be assigned a tutor, with whom they will have regular meetings. In addition the students will have all the standard induction, advice and supervisory arrangements normally offered to students within SMS.

The programme will incorporate a robust advising process to support students in choosing the relevant pathway leading to the desired level of accreditations gained.

The school handbook will be provided (and made accessible at all times) to students, where all the channels of support will be outlined. These include the support channels within the school and also those available at College level.

Programme-specific rules and facts
N/A
How inclusive is the programme for all students, including those with disabilities?

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:
- Finding out if you have a specific learning difficulty like dyslexia
- Applying for funding through the Disabled Students’ Allowance (DSA)
- Arranging DSA assessments of need
- Special arrangements in examinations
- Accessing loaned equipment (e.g. digital recorders)
- Specialist one-to-one “study skills” tuition
- Ensuring access to course materials in alternative formats (e.g. Braille)
- Providing educational support workers (e.g. note-takers, readers, library assistants)
- Mentoring support for students with mental health issues and conditions on the autistic spectrum.

Links with employers, placement opportunities and transferable skills

The staff involved in the MSc in Actuarial Science and Data Analytics have strong links with the actuarial profession and a range of international academic institutions. Some of our faculty members Fellows and Independent Examiners with the IFoA, one of whom received recognition via a Frank Redington Prize from the IFoA in 2022. Companies are involved in some of the teaching activities, as well as business use cases, such as SAS.

Many of the skills taught in this programme are highly transferable. For example, the programming skills (especially in Python) are widely sought by employers in the actuarial profession.

Programme Specification Approval

| Person completing Programme Specification: | Sebastian del Bano Rollin, DDoE |
| Person responsible for management of programme: | Shabnam Beheshti, DoE |
| Date Programme Specification produced / amended by School / Institute Education Committee: | 3 Jul 2023 |
| Date Programme Specification approved by Taught Programmes Board: | TBC |
Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are **only** to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

*By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.*

## Section 1 - Summary Information

<table>
<thead>
<tr>
<th>Module title:</th>
<th>Actuarial Risk Management 1</th>
<th>Module code:</th>
<th>MTH/XXX</th>
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<td>Module type:</td>
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</tr>
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<td></td>
<td></td>
<td>Scheme:</td>
<td>Taught Postgraduate</td>
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<tr>
<td>Start date:</td>
<td>September 2024</td>
<td></td>
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<td>Proposed HECoS Code:</td>
<td>100106 actuarial science</td>
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</table>

Further details on HECoS codes can be found [here](#).

**Responsible School / Institute:** School of Mathematical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

N/A

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Mathematical Sciences</td>
<td>Mathematical Sciences (PGT)</td>
</tr>
<tr>
<td>Year of Registration</td>
<td>Anticipated Student Intake</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>2023/24</td>
<td>38</td>
</tr>
<tr>
<td>2024/25</td>
<td>50</td>
</tr>
<tr>
<td>2025/26</td>
<td>60</td>
</tr>
</tbody>
</table>

**Module Rationale**

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This module is a compulsory module in the MSc in Actuarial Science and Data Analytics and in MSc in Risk Analytics. It provides the essential knowledge of risk management techniques and processes required by actuaries and financial professionals. It covers material of Actuarial Practice (CP1) of the IFoA examinations.

The module focuses on explaining key concepts in actuarial risk management. It provides an understanding of how risks faced both by individuals and groups may affect financial products and their providers. It explains the principles and techniques used to manage these risks.

**Resource Requirements**

<table>
<thead>
<tr>
<th>By School / Institute responsible for module:</th>
<th>1 standard lecturer load</th>
</tr>
</thead>
<tbody>
<tr>
<td>By any other School / Institute or collaborating institution:</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Approval of New Module Proposal**

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).
Section 2 - Module Specification

Module title: Actuarial Risk Management 1  Module code: MTH7XXX
Credit value: 15  Level: 7  Mode of Delivery: On Campus  Semester: Semester 1
Module Organiser: Dr Melania Nica

Pre-requisite modules  Co-requisite modules  Overlapping modules

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

This module will start by providing an understanding of actuarial advice and how it can be used to meet the needs of stakeholders in both public and private institutions. The module will provide a deep understanding of the actuarial control cycles with their applications. We will also study risk governance, risk identification and classification, risk measurement and responses to risk. We consider scenario analysis, stress-testing and stochastic modeling in the evaluation of risk. The module will focus on capital management and monitoring and it will end with an overview of the general business environment.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

1. Broad Educational Purposes:
   - Provide a comprehensive demonstration of a detailed knowledge and understanding of actuarial risk management.
   - Foster critical thinking skills of the topic and demonstrate ability to apply the principles of actuarial risk to particular topics.
   - Demonstrate ability to perform deeper analysis and assessment of applied practical problems including comparing and contrasting situations, suggesting possible solutions and actions and making actuarial recommendations.
   - Develop effective communication of actuarial concepts and solving of problems to diverse audiences.

2. The aim of this module is to develop the student's ability to apply a wide range of key actuarial concepts in simple traditional and non-traditional situations.
Outline syllabus includes:
   - Stakeholders and benefits: main providers of benefits on contingent events; main types of social security benefits and financial products; principles of insurance and pensions and their impact on these benefits and products.
   - The Actuarial Control Cycle: application as a risk management control cycle.
   - Risk governance: the risk management process for a business that can aid in the design of financial products; differences between risk and uncertainty and between systematic and diversifiable risk; how enterprise risk management can add value to the management of a business; the roles and responsibilities of various stakeholders in the management of risk.
   - Risk identification and classification: the risks and uncertainties affecting the level and incidence of benefits payable on contingent events and the overall security of benefits payable on contingent events; awareness and understanding of the risk categories that apply to businesses in general, and particularly financial services businesses.
   - Risk measurement and monitoring: scenario analysis, stress-testing and stochastic modeling in the evaluation of risk; different methods of risk aggregation and explains their relative advantages and disadvantages; how reporting risk that can be used by the main providers of financial products.
   - Responses to risk: methods of risk acceptance, rejection, transfer and management for stakeholders; differences between risks taken as an opportunity for profit and the risks to be mitigated; the principle of pooling risks and the methods of transferring risks; risk management strategies.
   - Capital management and monitoring: the interrelationship between risk and capital management; implications of risk for capital requirement, including economic and regulatory capital requirements; discusses the implications of the regulatory environment in which the business is written for provisioning and capital requirements. Risk-based capital in comparison with
other measures of capital needs; uses of internal models for assessment of economic and regulatory capital requirements.
- The general business environment: regulatory environment, external environment, investment environment.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

<table>
<thead>
<tr>
<th>Academic Content:</th>
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<tbody>
<tr>
<td>A1</td>
</tr>
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<td>A3</td>
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<table>
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</tr>
<tr>
<td>C2</td>
</tr>
<tr>
<td>C3</td>
</tr>
</tbody>
</table>

4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.


5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

<table>
<thead>
<tr>
<th>1. Student / lecturer interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.</td>
</tr>
<tr>
<td>3-hour lectures, 1-hour tutorial (4 hours x 11 sessions = 44 hours)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Student independent learning time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.</td>
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<tr>
<td>115 hours</td>
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<table>
<thead>
<tr>
<th>1. + 2. Total module notional study hours</th>
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</thead>
<tbody>
<tr>
<td>Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.</td>
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<tr>
<td>150 hours</td>
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</table>

6) Assessment Profile
Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment</th>
<th>Qualifying Mark for Individual Assessment</th>
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<td>Qualifying Mark for Individual Assessment</td>
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<td>2</td>
<td>Final exam</td>
<td>Examination (EXM)</td>
<td>2h</td>
<td>80%</td>
<td>Yes</td>
<td>Qualifying Mark for Individual Assessment</td>
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</table>

**Final element of assessment**: The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark**: A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

Reassessment
Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- **Standard Reassessment**
Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
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</table>

Section 3 - Alternative Assessment Arrangements for Associate Students

This section must only be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b)

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Actuarial Risk Management 2
Module code: MTH/XXX
Credit value: 15
Level: 7
Module type: LSR
Module type: Taught Postgraduate
Start date: September 2024
Proposed HECoS Code: 100106 actuarial science

Further details on HECoS codes can be found here

Responsible School / Institute: School of Mathematical Sciences

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<th>% of total teaching to be delivered</th>
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Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

N/A

Responsible School / Institute | Subject Exam Board responsible for the module
--- | ---
School of Mathematical Sciences | Mathematical Sciences (PGT)
**Anticipated Student Registrations**

<table>
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<td>2025/26</td>
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<td>45</td>
<td>110</td>
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**Module Rationale**

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This module is a compulsory module in the MSc in Actuarial Science and Data Analytics and elective module in MSc in Risk Analytics. It provides the essential knowledge of risk management techniques and processes required by actuaries and financial professionals. It covers material from the second part of Actuarial Practice (CP1) syllabus of the IFoA examinations.

The module focuses on identifying problems in actuarial practice and it teaches students to produce and recommend practical solutions using appropriate modeling assumptions and techniques. It also takes the solutions to the implementation stage with a focus on maintaining firm profitability, reporting results, insolvency and closure and options and guarantees. The module provides an understanding and assessment of actuarial practice monitoring of actuarial practice. It teaches students how to use the results of the monitoring process in the Actuarial Control Cycle or the Risk Management Control Cycle for future financial planning.

**Resource Requirements**

<table>
<thead>
<tr>
<th>By School / Institute responsible for module:</th>
<th>1 standard lecturer load</th>
</tr>
</thead>
<tbody>
<tr>
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<td>N/A</td>
</tr>
</tbody>
</table>

**Approval of New Module Proposal**

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

**Head(s) of supporting School / Institute**
Section 2 - Module Specification

Module title: Actuarial Risk Management 2
Module code: MTH7XXX
Credit value: 15
Level: 7
Mode of Delivery: On Campus
Semester: Semester 2

Module Organiser: Dr Melania Nica

Pre-requisite modules
Actuarial Risk Management 1

Co-requisite modules

Overlapping modules

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

This module will start by introducing students to contract design of financial products. We will consider the process of gathering and using appropriate data for recommending actuarial solutions. We will then move to modelling - we will learn how to analyse mortality and morbidity data, including factors that contribute to the variation in mortality and morbidity by region and in different social and economic environment. We will also study the cost and the pricing of providing benefits on contingent events. We will finally consider investment management (valuation of individual investments and valuation of portfolios of investments). The module also will provide understanding of the process of implementing and monitoring of actuarial solutions.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

1. Broad Educational Purposes:
   - Provide a comprehensive demonstration of a understanding of actuarial risk management modeling, implementation of actuarial solutions with monitoring and adjusting of strategies for future planning.
   - Foster critical thinking skills to apply the principles of actuarial risk to design financial products use to mitigate different risk.
   - Demonstrate ability to perform deeper analysis and assessment of applied practical problems including comparing and contrasting situations, suggesting possible solutions and actions and making actuarial recommendations.
   - Develop effective communication of actuarial concepts and solving of problems to diverse audiences.

2. The aim of this module is to develop the student’s ability to apply a wide range of key actuarial concepts in simple traditional and non-traditional situations.

Outline syllabus includes:
1. Identifying problems (actuarial or financial):
   - Contract design: factors to be considered in designing financial products
   - Data: ethical and regulatory issues involved in working with personal data and extremely large data sets; risks and ethical issues associated with use of data (including algorithmic decision making); data requirements for determining values for assets, future benefits and future funding requirements; checks; unavailability of data and ways to overcome it.
2. Producing solutions
   - Modeling: construction of actuarial models to produce solutions (objectives, operational issues in designing and running models); use of models for pricing or setting future financing strategies, risk management)
   - Mortality and morbidity: principal forms of heterogeneity within a population, the ways in which selection can occur and how the use of risk classification can address the consequences of selection; factors that contribute to the variation in mortality and morbidity by region and according to the social and economic environment (occupation, nutrition, housing, climate/geography, education, genetics); mortality convergence and decrements
   - The cost and the pricing of providing benefits on contingent events.
   - Investment management: principles and objectives of investment management; analyses the investment needs, taking into account liabilities, liquidity requirements and the risk appetite of the investor; valuation of individual investments; valuation of portfolios of investments
   - Provisioning: determining values for provisions; the principles of ‘fair valuation’ of assets and liabilities and other ‘market
consistent' methods of valuing the liabilities; sensitivity analysis to check the appropriateness of the values; different methods of allowing for risk in cash-flows; different methods of allowing for uncertainty in present values of liabilities;
- Relationship between assets and liabilities: asset/liability matching requirements of the main providers of benefits on contingent events; actuarial techniques such as asset/liability modelling to be used to develop an appropriate investment strategy, monitor investment performance and to review investment strategy
3. Living with the solution: maintaining profitability; performance of an investment portfolio against a benchmark; reporting actual results; insolvency and closure; options and guarantees
4. Monitoring

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

<table>
<thead>
<tr>
<th>Academic Content:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1 Demonstrate a comprehensive understanding of financial risk management specifically applied to actuarial enterprises such as insurance companies and pension funds, including the role of regulation in determining the nature of reporting and monitoring.</td>
</tr>
<tr>
<td>A 2 Apply appropriate analytical and statistical methods to analyze and interpret available data with the purpose of designing financial products in different industries (e.g. general and life insurance, pension funds, investment banking, etc.).</td>
</tr>
<tr>
<td>A 3 Demonstrate ability to interpret and evaluate problems in actuarial practice with the aim of extrapolating and producing new actuarial solutions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disciplinary Skills - able to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 1 Proficiently apply actuarial risk management analysis to implement and monitor actuarial solutions</td>
</tr>
<tr>
<td>B 2 Development of the ability to apply rigorous techniques to interpret mortality and morbidity data and their use in designing new financial products. At the same time ability to comprehend ethical issues involved in working with personal data.</td>
</tr>
<tr>
<td>B 3 Effectively communicate actuarial concepts, analyses, and results to both technical and non-technical audiences through written reports and oral presentations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attributes:</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 1 Develop critical thinking skills to integrate and weigh the validity and reliability of risk management processes in whole enterprise actuarial practice.</td>
</tr>
<tr>
<td>C 2 Enhance problem-solving abilities by applying appropriate techniques to real-world scenarios and actuarial challenges, keeping in mind multiple trade-offs.</td>
</tr>
<tr>
<td>C 3 Embed a strong attention to detail, accuracy, and professionalism when working with data.</td>
</tr>
</tbody>
</table>
4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.


5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

<table>
<thead>
<tr>
<th>1. Student / lecturer interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity</td>
</tr>
<tr>
<td>3-hour lectures, 1-hour tutorial (4 hours x 11 sessions = 44 hours)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Student independent learning time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.</td>
</tr>
<tr>
<td>115 hours</td>
</tr>
</tbody>
</table>

1. + 2. Total module notional study hours

| Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours. |
| 150 hours |

6) Assessment Profile
Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Midterm assignment</td>
<td>Coursework (CWK)</td>
<td>1 week</td>
<td>20%</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Final exam</td>
<td>Examination (EXM)</td>
<td>2h</td>
<td>80%</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
**Final element of assessment:** The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark:** A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

**Reassessment**
Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- **Standard Reassessment**
- **Synoptic Reassessment**

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
</table>

**Section 3 - Alternative Assessment Arrangements for Associate Students**

This section **must only** be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

**Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)**

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

**Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)**

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.
Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

**By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.**

### Section 1 - Summary Information

<table>
<thead>
<tr>
<th>Module title:</th>
<th>Actuarial Science and Data Analytics Dissertation</th>
<th>Module code:</th>
<th>MTH/XXX</th>
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</thead>
<tbody>
<tr>
<td>Credit value:</td>
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<td>Level:</td>
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<td></td>
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<td>Module type:</td>
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<td></td>
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<td>Scheme:</td>
<td>Taught Postgraduate</td>
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<td>Start date:</td>
<td>September 2024</td>
<td></td>
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<tr>
<td>Proposed HECos Code:</td>
<td>100106 actuarial science</td>
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</tbody>
</table>

Further details on HECos codes can be found [here](#).

**Responsible School / Institute:** School of Mathematical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

N/A

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Mathematical Sciences</td>
<td>Mathematical Sciences (PGT)</td>
</tr>
</tbody>
</table>
### Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024/25</td>
<td>20</td>
<td>15</td>
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<tr>
<td>2026/27</td>
<td>30</td>
<td>15</td>
<td>35</td>
</tr>
</tbody>
</table>

### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This will be a core module in the Actuarial Science and Data Analytics MSc and is being designed for this purpose. It is designed to provide students with the skills and expertise to perform independent research including modelling and communication of results in collaboration with a supervisor.

### Resource Requirements

<table>
<thead>
<tr>
<th>By School / Institute responsible for module:</th>
<th>Staff time to supervise MSc projects for the students on the programme; computational resources to support modelling projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>By any other School / Institute or collaborating institution:</td>
<td></td>
</tr>
</tbody>
</table>

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

Alex Clark  
Digitally signed by Alex Clark  
Date: 2023.07.03 10:20:15 +01'00'

**Head(s) of supporting School / Institute**

**Head(s) of supporting School / Institute**
Section 2 - Module Specification

Module title: Actuarial Science and Data Analytics Dissertation
Module code: MTH7XXX

Credit value: 60  Level: 7  Mode of Delivery: On Campus  Semester: Semester 3

Module Organiser: Dr Melania Nica

<table>
<thead>
<tr>
<th>Pre-requisite modules</th>
<th>Co-requisite modules</th>
<th>Overlapping modules</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Content Description

Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

Each Actuarial Science and Data Analytics MSc student is required to complete a 60 credit project dissertation. Students may find a potential supervisor and fill out an Approval Form by the end of Semester B. The module organiser will support this process and ensure that all students are allocated supervisor and project.

The supervisor and project must be approved by the Actuarial Science and Data Analytics MSc Programme Director, and the process for this, which may involve an interview with the student, takes place as approval forms are submitted. A typical MSc project dissertation consists of about 30 word-processed pages, covering a specific research-level, industry applied topic in Actuarial Science and Data Analytics. The dissertation will follow the CP2 and CP3 (Core Practices) syllabuses of IFoA examinations. The project will consist of two parts: modelling and communication. The modelling part ensures that the student is able to critically analyse and model commonly used data in actuarial work, maintaining an audit trail, using analytical and statistical methods (performing computation, simulations, or analysis) and generate innovative outputs. The communication part ensures that the student is able to communicate effectively in writing to both actuarial and non-actuarial audiences. An oral presentation of results may be required. The student usually will work on case studies in order to understand and explain actuarial questions. Results from one or more journal articles need to be applied. An MSc project may also involve collaboration with a collaborator based in industry. An MSc project should help prepare students for working as qualified actuaries and even following PhD research.

2) Module Aims

Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

The dissertation will give students the opportunity to apply a research-based approach to answering practical questions in insurance, pensions, healthcare, risk, investment, and other topics relevant to actuarial practice. It represents an opportunity to consolidate and expand the learning experience of students.

3) Learning Outcomes

Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:
Disciplinary Skills - able to:

B1 synthesise knowledge of several areas of a topic into a coherent dissertation

B2 evaluate the work of the dissertation and its relationship to current research in the area and real-life solutions

Attributes:

C1 work independently as well as with a project supervisor

C2 ability to write a coherent report and deliver a convincing presentation

4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.

Will depend on the topic of project.

Useful modeling resources are:


Some relevant academic journals are:
Annals of Actuarial Science
Journal of Risk and Insurance
Insurance: Mathematics and Economics
North American Actuarial Journal
Geneva Papers on Risk and Insurance

In addition, students may review research reports produced by IFoA (available at https://actuaries.org.uk/thought-leadership/research/) and the Society of Actuaries, USA (available at https://www.soa.org/research/research-topic-list/).

5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

1. Student / lecturer interaction
Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity. 10 hours of contact with project supervisor

2. Student independent learning time
Specify an indicative number of independent hours of study a 590 hours of self study and report production
student undertaking this module would be expected to undertake.

1. + 2. Total module notional study hours

Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

600 notional study hours

6) Assessment Profile
Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dissertation</td>
<td>Dissertation (DJS)</td>
<td>6,000 - 10,000 words</td>
<td>100</td>
<td>Yes</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Final element of assessment: The assessment that takes place last. There should be only ONE element of assessment marked as final.

Qualifying mark: A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

Reassessment
Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

☐ Standard Reassessment
☐ Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

Section 3 - Alternative Assessment Arrangements for Associate Students

This section must only be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.
Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

**By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.**

### Section 1 - Summary Information

<table>
<thead>
<tr>
<th>Module title:</th>
<th>Financial Engineering</th>
<th>Module code:</th>
<th>MTH/XXX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit value:</td>
<td>15</td>
<td>Level:</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Module type:</td>
<td>LSR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scheme:</td>
<td>Taught Postgraduate</td>
</tr>
<tr>
<td>Start date:</td>
<td>September 2024</td>
<td>Proposed HECoS Code:</td>
<td>100106 actuarial science</td>
</tr>
</tbody>
</table>

Further details on HECoS codes can be found [here](#).

**Responsible School / Institute:** School of Mathematical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
</table>
| X School of Mathematical Sciences | 100%

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Mathematical Sciences</td>
<td>Mathematical Sciences (PGT)</td>
</tr>
</tbody>
</table>
### Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
</tr>
</thead>
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<td>35</td>
</tr>
<tr>
<td>2025/26</td>
<td>25</td>
<td>15</td>
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</tr>
<tr>
<td>2026/27</td>
<td>30</td>
<td>15</td>
<td>35</td>
</tr>
</tbody>
</table>

### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This module is an elective module for Actuarial Science and Data Analytics MSc. It covers advanced material of Actuarial Mathematics Core Principle (CM2) of the IFoA examinations.

This module covers advanced techniques needed by actuaries to perform efficiently in roles in financial engineering. These techniques include the discrete-time binomial model, continuous time models, the Black-Scholes equation derived using stochastic calculus. We also consider advanced applications, such as models for stock prices involving jumps and stochastic volatility, as well as interest rate models.

### Resource Requirements

<table>
<thead>
<tr>
<th>By School / Institute responsible for module:</th>
<th>1 standard lecturer load</th>
</tr>
</thead>
<tbody>
<tr>
<td>By any other School / Institute or collaborating institution:</td>
<td></td>
</tr>
</tbody>
</table>

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

Alex Clark

Digitally signed by Alex Clark

Date: 2023.07.03
10:21:19 +01'00'

**Head(s) of supporting School / Institute**

**Head(s) of supporting School / Institute**
Section 2 - Module Specification

Module title: Financial Engineering  Module code: MTH7XXX
Credit value: 15  Level: 7  Mode of Delivery: On Campus  Semester: Semester 2
Module Organiser: 

<table>
<thead>
<tr>
<th>Pre-requisite modules</th>
<th>Co-requisite modules</th>
<th>Overlapping modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

This module covers advanced techniques in financial engineering, which are essential if you want to pursue jobs in financial institutions. We first study the discrete-time binomial model for asset pricing, introducing some more formal concepts such as conditional expectations. Then we look at continuous time models, and use the tools of stochastic calculus to derive the Black-Scholes equation. We solve explicitly for the prices of European call and put options. We also consider some more advanced applications, such as models for stock prices involving jumps and stochastic volatility, as well as interest rate models.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

The aim of this module is to provide a grounding in the principles of modelling as applied to actuarial work – focusing particularly on stochastic models for security prices, valuation of financial derivatives as well as models for term structures of interest rates. These skills are also required to communicate with other financial professionals and to critically evaluate modern financial theories.

Indicative topics covered by the module include theories of stochastic investment return models, models for the term structure of interest rates and option theory.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEE Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

A1 Systemically understand continuous-time stochastic processes, and apply them to financial derivative pricing.

A2 Comprehensively understand Geometric Brownian motion, and deploy originality in its application to pricing models.

A3 Demonstrate comprehensive grasp of the Black-Scholes Formula, properties of the Black-Scholes option cost, and Arbitrage strategy, and critically evaluate them.
A4. Comprehensively analyse and interpret models of term structure of interest rate and their applicability to observed behavior in the financial market.

**Disciplinary Skills - able to:**

<table>
<thead>
<tr>
<th>B1</th>
<th>Proficiently use the Black-Scholes model to model the no-arbitrage price of a European options. Analyse and interpret economic implications associated with financial models in terms of mathematical concepts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2</td>
<td>Critically evaluate models which are extensions or modifications of Geometric Brownian motion and their applicability at modelling observed data.</td>
</tr>
<tr>
<td>B3</td>
<td>Flexibly apply techniques developed in differential equations and probability to analysis of various financial models.</td>
</tr>
<tr>
<td>B4</td>
<td>Effectively communicate financial concepts, theories, analyses, and results to both technical and non-technical audiences through written reports and oral presentations.</td>
</tr>
<tr>
<td>B5</td>
<td>Efficiently compare results from application of theories learnt in the module with the observed behavior of security prices and returns.</td>
</tr>
</tbody>
</table>

**Attributes:**

<table>
<thead>
<tr>
<th>C1</th>
<th>Enhance ability to apply financial knowledge to actuarial problems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>Connect efficiently information and ideas within actuarial but also financial roles. This also involves continuous developing of analytical skills but also awareness at the ever evolving financial products and markets.</td>
</tr>
<tr>
<td>C3</td>
<td>Develop enhanced ability to proficiently present financial data visualization.</td>
</tr>
<tr>
<td>C4</td>
<td>Engage critically in the investigate of unfamiliar problems, identify information needed in different situations and applicability of the correct method of analysis (whether theoretical or statistical).</td>
</tr>
<tr>
<td>C5</td>
<td>Cultivate a strong attention to detail, accuracy, and professionalism when working with financial data.</td>
</tr>
</tbody>
</table>

### 4) Reading List

Please provide an indicative reading list for the module. This should include key texts and/or journals but **should not** be an exhaustive list of materials.


### 5) Teaching and Learning Profile

Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.
### 1. Student / lecturer interaction

Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.

<table>
<thead>
<tr>
<th>Lectures: 24 hours</th>
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</thead>
<tbody>
<tr>
<td>Tutorials: 11 hours</td>
</tr>
</tbody>
</table>

### 2. Student independent learning time

Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

| 115 hours |

### 1. + 2. Total module notional study hours

Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

| 150 hours |

### 6) Assessment Profile

Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Final written exam</td>
<td>Examination (EXM)</td>
<td>3 hours</td>
<td>80</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Assessed coursework</td>
<td>Coursework (CWK)</td>
<td>1 week</td>
<td>20</td>
<td>No</td>
</tr>
</tbody>
</table>

**Final element of assessment:** The assessment that takes place last. There should be only ONE element of assessment marked as final.

**Qualifying mark:** A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

**Reassessment**

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- ☐ Standard Reassessment
- ☐ Synoptic Reassessment

**Synoptic reassessment details** (if you have indicated synoptic reassessment above, please give details)

<table>
<thead>
<tr>
<th>Sequence</th>
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</tr>
</tbody>
</table>
Section 3 - Alternative Assessment Arrangements for Associate Students

This section must only be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Foundations of Mathematics and Statistics  Module code: MTH/XXX
Credit value: 15  Level: 7  Module type: LSR  Scheme: Taught Postgraduate
Start date: September 2024
Proposed HECoS Code: 101030 applied statistics

Further details on HECoS codes can be found here

Responsible School / Institute: School of Mathematical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

Responsible School / Institute | Subject Exam Board responsible for the module
School of Mathematical Sciences | Mathematical Sciences (PGT)
### Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
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<tbody>
<tr>
<td>2024/25</td>
<td>88</td>
<td>60</td>
<td>135</td>
</tr>
</tbody>
</table>

### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This module is a compulsory module for following two MSc programmes:
1. Actuarial Science MSc,
2. Risk Analytics MSc.

This module covers the mathematical foundation for risk management. It introduces necessary analytical tools for risk management, including an overview of various loss distribution models, compound distributions and their applications in risk modelling, copulas and extreme value theory. We also discuss stochastic modelling and stochastic processes, covering discrete time processes including Markov chains and random walks, and continuous time processes such as Poisson processes.

It covers material of the syllabuses of CS2 (random variables and distributions for risk modelling, stochastic processes) of the IFoA examinations.

### Resource Requirements

<table>
<thead>
<tr>
<th>By School / Institute responsible for module:</th>
<th>1 standard lecturer load</th>
</tr>
</thead>
<tbody>
<tr>
<td>By any other School / Institute or collaborating institution:</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

[Signature]

**Head(s) of supporting School / Institute**

[Signature]
Section 2 - Module Specification

Module title: Foundations of Mathematics and Statistics  Module code: MTH7XXX
Credit value: 15  Level: 7  Mode of Delivery: On Campus  Semester: Semester 1
Module Organiser: TBC

<table>
<thead>
<tr>
<th>Pre-requisite modules</th>
<th>Co-requisite modules</th>
<th>Overlapping modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

This module introduces necessary analytical tools for risk management. After an introduction on basic statistics and probability used in physical and life sciences and economics, we give an overview of various loss distribution models, which are applied to liability valuations. We then discuss compound distributions and their applications in risk modelling. To manage dependent and extreme risks, we discuss copulas and extreme value theory. We also discuss stochastic modelling and stochastic processes. It covers discrete time processes including Markov chains and random walks, and continuous time processes such as Poisson processes. This module includes real-world data application using R.

This module lays the mathematical foundation for risk management, and prepares you to be professional risk manager and actuary in global business environments.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

The module aims include:
1. To equip students with statistical and analytical tools in risk management.
2. To develop students’ risk analytical skills to analyse real-world risk data using R.
3. To train students’ critical thinking by evaluating the pros and cons of all the risk models.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

Academic Content:

A1 Systematically understand various loss distributions models and compound distributions, and critically evaluate the pros and cons of different risk distributions.

A2 Deploy originality in the application of risk distributions to liability valuations, especially in the context of ruin theory and run-off triangles.
### A3
Comprehensively understand how extreme value theory and copula can be used to model extremely severe loss and tail dependence.

### A4
Demonstrate comprehensive grasp of stochastic processes, and act autonomously in choosing the appropriate Markov chain or Markov process to model certain risks.

### Disciplinary Skills - able to:

| B1 | Creatively apply appropriate statistical tools to model real-world risks, and estimate model parameters using methods such as maximum likelihood functions. |
| B2 | Critically evaluate the limitations of each risk model, and propose appropriate methods to overcome the limitations. |
| B3 | Proficiently use R to creatively construct risk analytical models, and predict risks. |

### Attributes:

| C1 | Bear the responsibility of risk managers in their mind, e.g., manage risk in the context of the whole economy, ensuring global financial stability, rather than selfishly focus on the benefit of a single organization. |
| C2 | Demonstrate effective data visualisation and communication skills. |
| C3 | Produce analyses grounded on evidence from different data sources and analytical tools, and present the conclusions in the form of written research work and oral presentation. |

### 4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but **should not** be an exhaustive list of materials.


### 5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

1. **Student / lecturer interaction**
   - Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.

2. **Student independent learning time**
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student undertaking this module would be expected to undertake.

1. + 2. Total module notional study hours

Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

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Reassessment

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- ☐ Standard Reassessment
- ☐ Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

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</table>

**Section 3 - Alternative Assessment Arrangements for Associate Students**

This section **must only** be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.
Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

Module Proposal Form (PG)

Sections 1 and 2 must be completed in full. Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b).

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

Section 1 - Summary Information

Module title: Mathematical Tools for Asset and Liability Management
Module code: MTH/XXX
Credit value: 15
Level: 7
Module type: LSR
Scheme: Taught Postgraduate
Start date: September 2024
Proposed HECoS Code: 100106 actuarial science

Further details on HECoS codes can be found here

Responsible School / Institute: School of Mathematical Sciences

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

Responsible School / Institute | Subject Exam Board responsible for the module
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School of Mathematical Sciences | Mathematical Sciences (PGT)
<table>
<thead>
<tr>
<th>Year of Registration</th>
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</tr>
</thead>
<tbody>
<tr>
<td>2024/25</td>
<td>18</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>2025/26</td>
<td>25</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>2026/27</td>
<td>30</td>
<td>35</td>
<td>60</td>
</tr>
</tbody>
</table>

**Module Rationale**

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This module is an elective module for the MSc in Actuarial Science and Data Analytics. It covers material of the Actuarial Mathematics 2 (CM2) Core Principles syllabus of the IFOA examinations. This module looks at decisions and actions taken by organisations with respect to optimal allocation of assets and liabilities. This subject is critical for actuaries as they need to understand and advise sound management of the finances of any organization.

**Resource Requirements**

<table>
<thead>
<tr>
<th>By School / Institute responsible for module:</th>
<th>1 standard lecturer load</th>
</tr>
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<tbody>
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<td></td>
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**Approval of New Module Proposal**

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

Alex Clark

**Date:** 2023.07.03 10:22:40 +01'00'

**Head(s) of supporting School / Institute**

**Head(s) of supporting School / Institute**
Section 2 - Module Specification

Module title: Mathematical Tools for Asset and Liability Management  Module code: MTH7XXX
Credit value: 15  Level: 7  Mode of Delivery: On Campus  Semester: Semester 2
Module Organiser: Dr Melania Nica

Pre-requisite modules  Co-requisite modules  Overlapping modules
N/A  N/A  N/A

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

This module introduces key concepts in financial economics and risk management. We will learn economic theories used by investors to determine their optimal portfolio of investment: utility theory, stochastic dominance, mean-variance portfolio theory, CAPM, factor models and arbitrage pricing theory. We consider next efficient market theory. We learn various tests for testing efficient market theory. We also introduce stochastic models for asset prices. Finally we study topics related to ruin/risk theory and look at how insurance companies estimate their liabilities using run-off triangles.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

Broad educational purposes:
- Provide a comprehensive demonstration of detailed knowledge and understanding of how investors choose optimal investments.
- Foster critical thinking skills on the topic and demonstrate ability to understand usage of different optimization techniques based on the information available.
- Demonstrate ability to perform deeper analysis and assessment of applied practical problems, including comparing and contrasting real-life situations.

The overall aim of this module is to develop students’ ability to apply a wide range of financial engineering and loss reserving techniques while evaluating investment and risk.

This module covers the following topics:
1. Utility theory
2. Behavioral economics
3. Stochastic dominance
4. Risk and measures of investment risk
5. Mean-Variance portfolio theory
6. CAPM
7. Factor models and APT
8. Efficient market theory
9. Introduction to stochastic models for asset pricing
10. Ruin/Risk theory
11. Estimation of liabilities using run-off triangles
3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.

**Academic Content:**

| A1 | Systemically understand investment under uncertainty and measures of risk. |
| A2 | Comprehensively understand mean-variance portfolio theory, CAPM and APT and deploy originality in their application to finding optimal investment. |
| A3 | Demonstrate comprehensive grasp of ruin theory and estimation of liabilities |
| A4 | Comprehensively analyse and interpret financial data using Excel/VBA or R. |
| A5 | Ability to use Bloomberg terminals for access to news, data, unique insight and trading tools for gaining an extra layer of understanding of financial markets |

**Disciplinary Skills - able to:**

| B1 | Proficiently use the MVPT, CAPM and APT in evaluating returns on investments. |
| B2 | Critically evaluating Efficient Market Theory and understanding methods for testing it in different settings. |
| B3 | Flexibly apply techniques developed in utility theory (with rational agents) and behavioral finance (with bounded rationality) to understand puzzling situations in the financial markets. |
| B4 | Interpret economic implications associated with financial models in terms of mathematical concepts. |
| B5 | Effectively communicate financial and statistical concepts, analyses, and results to both technical and non-technical audiences through written reports and oral presentations. |

**Attributes:**

| C1 | Enhance problem-solving abilities by applying appropriate theoretical and statistical techniques to real-world scenarios in the financial markets. |
| C2 | Proficiently connect information and ideas in financial engineering and loss reserving and apply analytical skills to investigate unfamiliar problems. |
| C3 | Enhance ability to identify information needs appropriate to different situation and effectively and efficiently use financial data visualization. |
| C4 | Cultivate a strong attention to detail, accuracy, and professionalism when working with financial data. |
| C5 | Enhance abilities to recognize recognizing potential sources of bias and confounding which could affect actuarial advice. |
4) Reading List
Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.


5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

1. Student / lecturer interaction
Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.

3-hour lectures, 1-hour tutorial (4 hours x 11 sessions = 44 hours)

2. Student independent learning time
Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.

Pre-session readings (2 hours per session)
Self study (3 hours per session)
Coursework (2 hours per session)
Assessment preparation 29 hours

1. + 2. Total module notional study hours
Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.

150 hours

6) Assessment Profile
Please provide details of the assessment methods used to assess the achievement of learning outcomes.

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<td>Midterm assessment</td>
<td>Coursework (CWK)</td>
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<td>20</td>
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---

**Reassessment**

Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)

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**Section 3 - Alternative Assessment Arrangements for Associate Students**

This section **must only** be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

---

**Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)**

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

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**Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)**

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

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Module Proposal Form (PG)

Sections 1 and 2 must be completed in full.
Sections 3 and 4a/4b are only to be completed where the module will be available to associate students with either alternative assessment arrangements (section 3) or as a half module (sections 4a & 4b)

If you wish to change the title of a module, please use the Module Amendment Form.

By hovering over the blank boxes with your cursor further guidance will be displayed to aid completion.

**Section 1 - Summary Information**

<table>
<thead>
<tr>
<th>Module title:</th>
<th>Survival Models</th>
<th>Module code:</th>
<th>MTH/XXX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credit value:</td>
<td>15</td>
<td>Level:</td>
<td>7</td>
</tr>
<tr>
<td>Module type:</td>
<td>LSR</td>
<td>Scheme:</td>
<td>Taught Postgraduate</td>
</tr>
<tr>
<td>Start date:</td>
<td>September 2024</td>
<td>Proposed HECoS Code:</td>
<td>100106 actuarial science</td>
</tr>
</tbody>
</table>

Further details on HECoS codes can be found here

<table>
<thead>
<tr>
<th>Responsible School / Institute:</th>
<th>School of Mathematical Sciences</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>School / Institute</th>
<th>% of total teaching to be delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Collaborating institutions involved in teaching part of the module (if applicable), including the estimated percentage contribution to the module from the collaborative partner:

N/A

<table>
<thead>
<tr>
<th>Responsible School / Institute</th>
<th>Subject Exam Board responsible for the module</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Mathematical Sciences</td>
<td>Mathematical Sciences (PGT)</td>
</tr>
</tbody>
</table>
### Anticipated Student Registrations

<table>
<thead>
<tr>
<th>Year of Registration</th>
<th>Anticipated Student Intake</th>
<th>Minimum Student Intake</th>
<th>Maximum Student Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>2024/25</td>
<td>18</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>2025/26</td>
<td>25</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>2026/27</td>
<td>30</td>
<td>35</td>
<td>60</td>
</tr>
</tbody>
</table>

### Module Rationale

Please provide a rationale for the introduction of the module and specify for which programme(s) of study the module is designed and whether it will be offered as a core, compulsory or option module. If the programme(s) concerned comprise a number of dedicated pathways / routes the status of the module on each should also be made clear.

This module is an elective module for the MSc in Actuarial Science and Data Analytics and it provides the essential knowledge of survival models techniques required by all actuaries. It covers material of Actuarial Statistics Core Principles (CS2) syllabus of the IFoA examinations. The students will gain strong analytical knowledge in survival models and their applications needed for actuarial roles in insurance and pensions.

### Resource Requirements

| By School / Institute responsible for module: | 1 standard lecturer load |
| By any other School / Institute or collaborating institution: | N/A |

### Approval of New Module Proposal

The signature of the Head(s) of School(s) / Institute(s) will be taken as confirmation that the School or Institute can fund the required resources, both internal and elsewhere (for example: staffing, library and computing resources).

**Head(s) of School / Institute**

[Signature]

**Head(s) of supporting School / Institute**

[Signature]
Section 2 - Module Specification

Module title: Survival Models  Module code: MTH7XXX
Credit value: 15  Level: 7  Mode of Delivery: On Campus  Semester: Semester 1
Module Organiser:

Pre-requisite modules  Co-requisite modules  Overlapping modules

1) Content Description
Please provide a description of the module, as it will appear in the Module Directory and on the Student Information System (approx. 70-80 words).

Survival models are of crucial importance in the Insurance and Pensions industry. This module covers part of the core principles syllabus of the IFoA's Subject Actuarial Statistics (CS2). The material covered includes the mathematics of survival models, estimation of lifetime distributions, Binomial and Poisson mortality models, graduation of crude rates, goodness-of-fit of derived models, and methods of projecting mortality rates. This module provides deep knowledge of a number of parametric and non-parametric statistical approaches and methods developed by actuaries using age-specific death rates for survival and mortality. Tests of the consistency of crude estimates with a standard table using a number of non-parametric methods is also studied.

2) Module Aims
Please specify the aims of the module, i.e. the broad educational purposes for offering this module.

Broad educational purposes:
On completion of this module, students will be able to:
- provide a comprehensive demonstration of detailed knowledge and understanding of survival models.
- demonstrate ability to apply survival modeling to problems in pensions and insurance.
- demonstrate ability to perform deeper analysis and assessment of applied practical problems.
- develop effective communication of actuarial concepts and solving of problems to diverse audiences.

The overall aim of this module is to develop students’ ability to apply survival modeling techniques and generalized linear models within the insurance and pensions framework.

Indicative topics will include:
- Density, distribution, survival and hazard functions for random future lifetimes; derivation of relationships between them.
- Estimation of the survival function from data and use of maximum likelihood estimation.
- Calculation of exposure to risk and crude mortality rates under Binomial and Poisson models, and estimation of parameters of well-known laws of mortality.
- Comparison of the Binomial model with multiple state models
- Estimation of transition intensities depending on age, exactly, or using the census approximation.
- The process of graduation, and testing of crude estimates for consistency with a standard table or a set of graduated estimates.
- Generalized linear models and applications to insurance business.

3) Learning Outcomes
Please identify the learning outcomes for this module, i.e. knowledge, skills and attributes to be developed through completion of this module. Outcomes should be referenced to the relevant QAA benchmark statements and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008). The SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes should also be used as a guiding framework for curriculum design.
### Academic Content:

<table>
<thead>
<tr>
<th>A1</th>
<th>Demonstrate a comprehensive understanding of fundamental actuarial modelling.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A2</td>
<td>Apply appropriate analytical and statistical methods such as survival models to problems faced by insurance firms, and pension funds.</td>
</tr>
<tr>
<td>A3</td>
<td>Critically evaluate case studies in actuarial practice and compare models for mortality.</td>
</tr>
<tr>
<td>A4</td>
<td>Critically evaluate research studies in medical statistics including observational studies, and meta-analyses in order to estimate current survival functions needed in the design of innovative insurance products.</td>
</tr>
</tbody>
</table>

### Disciplinary Skills - able to:

<table>
<thead>
<tr>
<th>B1</th>
<th>Proficiently use the lifetime, survivor and hazard functions and calculate them for various statistical distributions for life insurance products and pensions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2</td>
<td>Analyse and interpret large data sets using generalised linear model.</td>
</tr>
<tr>
<td>B3</td>
<td>Deep comprehension of non-parametric curves for survivor function or hazard. Ability to understand the likelihood for data with various sorts of censoring. Ability to carry out suitable statistical tests for consistency of crude estimates.</td>
</tr>
<tr>
<td>B4</td>
<td>Deep awareness of new emerging risks that need to be assessed, priced and mitigated. Climate change and pandemics could be some examples.</td>
</tr>
</tbody>
</table>

### Attributes:

<table>
<thead>
<tr>
<th>C1</th>
<th>Develop critical thinking skills to assess the validity and reliability of survival models in the actuarial profession.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>Enhance problem-solving abilities by applying appropriate statistical techniques (such as survival models and generalized linear models) to understanding and designing life insurance products and pensions.</td>
</tr>
<tr>
<td>C3</td>
<td>Cultivate a strong attention to detail, accuracy, and professionalism when working with mortality and morbidity data.</td>
</tr>
<tr>
<td>C4</td>
<td>Develop critical thinking skills to implement ethical standards when dealing with highly sensitive person (financial and in medical data).</td>
</tr>
<tr>
<td>C5</td>
<td>Enhance abilities to recognize recognizing potential sources of bias and confounding which could affect the statistical results.</td>
</tr>
</tbody>
</table>

### 4) Reading List

Please provide an indicative reading list for the module. This should include key texts and / or journals but should not be an exhaustive list of materials.


5) Teaching and Learning Profile
Please provide details of the method of delivery (lectures, seminars, fieldwork, lab work, etc.) used to enable the achievement of learning outcomes and an indicative number of hours for each activity to give an overall picture of the workload a student taking the module would be expected to undertake.

<table>
<thead>
<tr>
<th>1. Student / lecturer interaction</th>
<th>3-hour lectures, 1-hour tutorial (4 hours x 11 sessions = 44 hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify details of the method of delivery e.g. lectures, seminars, fieldwork, lab work etc. used to enable the achievement of the learning outcomes and an indicative number of hours for each activity.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Student independent learning time</th>
<th>115 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify an indicative number of independent hours of study a student undertaking this module would be expected to undertake.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1. + 2. Total module notional study hours</th>
<th>150 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify the total module notional study hours. This should be a total of the hours given in 1. and 2. The notional study hours for each academic credit point is 10. A 15 credit point module therefore represents 150 notional study hours.</td>
<td></td>
</tr>
</tbody>
</table>

6) Assessment Profile
Please provide details of the assessment methods used to assess the achievement of learning outcomes.

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Description of Assessment</th>
<th>Assessment Type</th>
<th>Duration / Length</th>
<th>% Weighting</th>
<th>Final element of assessment?</th>
<th>Qualifying Mark for Individual Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Midterm assignment</td>
<td>Coursework (CWK)</td>
<td>1 week</td>
<td>20%</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Final exam</td>
<td>Examination (CXM)</td>
<td>2h</td>
<td>80%</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Final element of assessment: The assessment that takes place last. There should be only ONE element of assessment marked as final.

Qualifying mark: A specified minimum mark that must be obtained in one or more elements of assessment in order to pass a module. This is in addition to, and distinct from, the requirement to achieve a pass in the module mark to pass the module.

Reassessment
Please provide details of the reassessment methods used, specifying whether reassessment is either standard reassessment or synoptic reassessment.

- Standard Reassessment
- Synoptic Reassessment

Synoptic reassessment details (if you have indicated synoptic reassessment above, please give details)
Section 3 - Alternative Assessment Arrangements for Associate Students

This section must only be completed if the module will be made available to associate students in Semester A and where the credit value of the "associate" version is the same as for the main version, and the main version is assessed by exam in May which is not available to the associate students. All other aspects of the module specification remain the same as indicated in Section 2 above. To add alternative assessment arrangements please click 'Add Alternative Assessment'.

Section 4a - Half Module for Associate Students (for a half module to be taught in Semester A)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester A. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester A)'.

Section 4b - Half Module for Associate Students (for a half module to be taught in Semester B)

This section must be completed if the proposed module will take place over 2 semesters but will be made available to single-semester associate students in a half-credit format in Semester B. Modules worth less than 30 credits taken over 2 semesters may not be made available in a half-credit format. To add details for the half module please click 'Add Half Module (Semester B)'.

<table>
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<th>Duration / Length</th>
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</thead>
</table>
