Royal Geographic Society Programme Accreditation

MSc Smart Cities and Urban Analytics

The Bartlett Centre for Advanced Spatial Analysis

Bartlett Faculty of the Built Environment

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MSc Smart Cities and Urban Analytics accreditation introduction

The MSc Smart Cities and Urban Analytics (SCUA) was created by the Bartlett Centre for Advanced Spatial Analysis (CASA) at University College London (UCL) in 2013, initially catering for around 10-15 students the programme has since expanded to 60-80 enrolments a year[1].

Our programme is unique in that it teaches students to take advantage of emerging city technological innovations to tackle some of the fundamental problems facing the urbanised world. Challenges of social equity, sustainability, land use, resource efficiency and effective planning and governance are shared and recognised by all cities (e.g. The London Plan, Johannesburg's Spatial Development Framework 2040 and Perth and Peel @3.5million) and international organisations (e.g. the United Nations Sustainable Development Goals and the New Urban Agenda) (City of Johannesburg Metropolitan Municipality, 2016; Mayor of London, 2021; UN-Habitat III, 2017; United Nations Sustainable Development Goals, 2018; Western Australian Planning Commission, 2018). The modules within our programme offer our students the exciting prospect of tackling these vital issues more effectively than ever before, drawing on both well-established scientific methods and the latest in urban analytic techniques, improving urban environments for all citizens, but crucially, in a data informed manner (McPherson, 2016; Michele Acuto, 2018).

With urban area predicted to triple by 2030 based current trends, increasing total global coverage to 0.9% of Earth's surface (2000 baseline of 652,825 km^2) alongside an expectation to accommodate 68% of the global population by 2050 (55% in 2018)

[1] The department also runs an MSc in Spatial Data Science and Visualisation (SDSV), MRes SDSV and a SCUA Royal Town Planning Institute (RTIP) accredited pathway (all not considered within this application). The MSc SDSV attracts 60-80 students per year, with the MRes SDSV and SCUA RTPI around 10 students per year. In total the department has between 100 and 150 students a year across the MSc and MRes degrees.

there has never been a more engaging time to study smart city advancements (Schneider et al., 2005; Seto et al., 2012; Sexton et al., 2013; United Nations, 2018). Whilst not considered a traditional geography programme, with a core focus on applied spatial urban-centric challenges within geographical space, this application adheres to the RGS accreditation requirements.

The MSc SCUA is divided into two strands of modules broadly classified as city theory and quantitative method modules, but importantly both centre on applied and real world examples. The programme summary contains a programme description (section 3.1.4) which should be read before the main part 1 content.

Part 1 of the application commences with subject coverage and integration of programme aims and RGS criteria, teaching and learning approaches and assessment strategies across all modules divided by terms, with integration summary tables concluding each section. It then discusses developments in relation to maintaining and monitoring standards, considering student feedback and external examination comments. Throughout part 1 the RGS criteria will be mapped against statements using the numbering provided within the handbook and the programme aims, the latter of which are detailed in the required programme summary, section 3.1. Unless otherwise stated all material including the student handbook (access details provided in section 3.4) is hosted on Moodle (UCL's course management system) and communication is primarily over Slack, with a channel dedicated to each module. Over the last year all teaching sessions have transitioned to video conferencing software, with the University implementing no detriment policies applicable to the programme.

Part 2 of the application moves to explore professional practice, drawing on specific examples of external engagement opportunities, the development of employability attributes integrated into the programme and career events.

Part 3 of the application contains required and additional supporting documents that have been referenced throughout parts 1 and 2.

1 The MSc Smart Cities and Urban Analytics programme

1.1 Term 1

During term 1 Urban Systems Theory provides a comprehensive introduction to the theory and science of cities. The module explores conceptual models of urban areas (1a, c) alongside the relationships between society and space and challenges faced between stakeholders when designing sustainable developments (1b). Many different perspectives developed by urban researchers, systems theorists, complexity theorists, urban planners, geographers and transport engineers are considered, such as spatial interactions and transport models, urban economic theories, scaling laws and the central place theory for systems of cities, growth and migration. A weekly annotated bibliography (provided within the supplementary folder) summarises the key concepts and theories along with brief research examples that are expanded upon in lectures.

Students must complete three assessments tasks, two written responses on theoretical concepts (e.g. planetary urbanism, conceptions of space) and a final task in which they must develop a study outline, for any city, that investigates either (a) urban health disparities or (b) the impact of compact urban form on sustainability, using a theoretical concept from task one or two (2a). Direct questions enable students to reinforce and demonstrate their understanding of the taught material, with the final assessment permitting applied creativity through appropriate approaches (1d).

The effect of the module material and assessment intends to build theoretical inquiry capacity in preparation for subsequent term 2 modules and future quantitative research established on this strong theoretical base. The module is delivered through weekly hour long lectures and guided independent study. It primarily contributes to the first programme aim of experiencing a range of theoretical perspectives on aspects of the urban environment (A1) and the RGS geographical

knowledge and understanding criterion (1) based on the range of theory and subsequent application to research design required.

Geographical Information Systems and Science offers students their first introduction to spatial data within the programme. It presents an overview of the core organising concepts, data formats and methodologies to solve spatial queries and inform decisions. The module was recently redeveloped to focus on open source software, primarily the R data science language but with mapping processes also covered in Quantum GIS (QQGIS). The content is divided into two five week parts – GIS tools and GIS analysis, being separated by a University wide reading week. The former focuses on subject based learning covering foundational geographical concepts, data formats, and libraries (Kwan, 2009) (3a, d). GIS analysis then transitions to a mixture of case and problem-based learning in which students are presented with examples of academic and policy-based geographic research questions, being walked through logical steps that lead to a data informed outcome. The change from ‘learning about’ to ‘learning with’ prepares students for the inquiry-based assignment in which they must apply their new skills to develop and answer a topical geo-spatial question in a reproducible manner (2a, b, c, 3b, c, 4a, c, e). As the weight of the assignment is a 100% report students are encouraged to submit an optional formative proposal for feedback during reading week and participate in the buddy scheme, where they are matched to another student to discuss their work, analysis and initial feedback.

The module is delivered through weekly hour long lectures and three hour practicals, with the final five weeks being supplemented by short seminars created by the postgraduate teaching assistants. As this course is compulsory for: MSc SCUA, MSc and MRes Spatial Data Science and Visualisation (CASA) and MSc Social and Geographic Data Science (UCL Geography) students are divided into one of two practical classes. Within the practical sessions instructors talk through and provide a live demonstration of the code, whilst discussing limitations and possible alternatives (3b) alongside breakouts for individual questions.

The short seminars were designed to allow teaching assistants to develop their own material on a related topic and demonstrate packages or methodologies in different scenarios. During the academic year 2019-2020 this included sessions on ggplot2, origin and destination data and the influence of poorly designed maps. Teaching assistants have successfully used these opportunities to attain Associate Fellowship of the Higher Education Academy, detailed in section 1.4.1. The progression from learning about geographic tools (e.g. packages), solving problems with geographical methods and seeing them in different contexts (e.g. within seminars) empowers students to creatively apply their knowledge to develop and answer their own spatial research question. The module contributes to the spatial skillset (A2) and research project (A5) programme aims alongside the RGS criteria of originality (2) and geographic skills (3). The module leader has put a significant amount of effort in creating an open source website that holds all practical content, detailing the annual revisions in the readme.md file on GitHub. In addition to the weekly division of assignment tasks there is a wealth of resources for students to explore for their assignment (Assignment section): https://andrewmaclachlan.github.io/CASA0005repo/. The course has also been submitted as a paper to the Journal of Open Source Education (see the supplementary folder).

The primary purpose of Geographical Information Systems and Science is to engage students with geographical problems, focusing on the application of spatial data. This is directly complemented by Introduction to Programming and Quantitative Methods. The former provides a comprehensive coverage of computation techniques, whilst the latter introduces students to a range of statistical and mathematical tools. Specifically, Introduction to Programming develops a basic understanding of programming elements and tools. The module was made optional last year to account for a small number of our students who have significant previous programming experience. Within introduction week SCUA students are strongly advised to take the module if they are unable to write and explain a for loop in Python as the language features throughout terms 2 and 3. The majority of students select the module as their only elective within the programme, however other options

are detailed within the module map (section 3.2) and module summaries (section 3.3).

The module has been modified and enhanced from the Department of Geography at King's College London, the convenor's previous institution (and module). It aims to frame programming techniques as part of the larger data science workflow actioned in exploratory data analysis, demonstrating the use of appropriate tools at each stage, using both non-spatial and spatial data (1d, 2a, b, c, 3a). Elements include functions, loops, conditions and object orientation whilst tools such as GitHub, Markdown and Notebooks are also covered. The taught material permits students to become familiar with and generalise programming concepts through the workflow process of data transformation, visualisation and interpretation that are applicable to other languages they may encounter throughout their degree and career (4c, e).

Similar to Geographic Information Systems and Science, the module is divided into three parts, logically progressing from Python basics (weeks 1-4) (3a, b) to data types and cleaning (weeks 5-7) and finally making sense of data (weeks 8-10) (3, c, d). The assessment replicates this structure, through: (1) a timed coding task, (2) a data biography reflecting on Inside Airbnb data in relation to the data collection methodology, completeness, and potential analysis and (3) an executive briefing written as if to brief the Mayor of the Greater London Authority or the Chief Executive of an investment company on the challenges/opportunities relating to Airbnb's operations in London through a reproducible Jupyter notebook (2a, 3c, d, 4a, c, e). In the final project students are free to select a narrower or different focus of their briefing but, for example, they may wish to develop the evidence either for/against the regulation of listings on Airbnb in London, or for/against investing in the Airbnb platform in London (2a, c, 3c). Assessment two is designed to provoke critical reflection about who and what 'counts' as well as the ethics of data (re)use, spatial uncertainty, and how data is generated (2a, 3c, d, 4a, d). This is furthered in the final project in a more reflective manner that recognises the limits of the data and the analyses that it supports (2 a-c, 3a, c-d, 4b).

The module is taught through a flipped classroom approach and students are expected to complete required reading and watch pre-recorded short videos on topics, with examples including: lists, iteration and Python basics (Tucker, 2012). Readings are selected to provoke critical reflection on quantitative data, including data feminism, feminist geography, critical GIS, data ethics, and investigations of the impact of Airbnb on cities and neighbourhoods (1a). The weekly lecture then discusses concepts in relation to: further live coding examples, student questions on Padlet and the weekly practical session. This live coding lecture follows an 'I do/we do/you do' format where the instructors employ concepts covered in the preparation activities, as well as approaches that will be explored further in the practical to look at real world data sets as a class using code. Students are divided into one of six practical classes where they work through programming tasks and ask questions. Individual support is available through weekly office hours. The effect of the module develops a broad understanding and sound base of programming, which is then expanded to real world scenarios, with the final assessment replicating tasks students will be faced with in future employment. For the academic year 2020-2021 the module leader re-developed the majority of the material, hosting it open access on GitHub: https://github.com/jreades/i2p/blob/master/Syllabus.md. The module contributes to the spatial skillset (A2) programme aims alongside a range of RGS criteria including originality (2), geographic skills (3) and transferable skills (4).

Quantitative Methods complements all aforementioned term 1 modules through demonstrating the integral part that quantitative approaches play in research and empowers students to understand the mechanisms underlying theories and models (1c, 3a). This is crucial when students encounter unexpected errors within data and code throughout their assessments and careers. Students are introduced to a range of quantitative approaches from the fields of statistics, modelling and data analysis, to serve as tools in other disciplines. Throughout the course, the focus is firmly on developing conceptual understanding, rather than detailed mathematical manipulation (1d). The module is divided into two parts, with the first five weeks focussing on basic quantitative approaches such as summarising data, linear regression and hypothesis testing. While the last four weeks move to more advanced and applied methods such as linear programming and modelling the world through

systems dynamics models, concluding with common statistical traps (2b). The module is delivered through a weekly series of a three hour lectures and associated Python practicals that students complete independently to reinforce taught concepts. Padlet forums enable students to respond to questions set by staff and ask questions that are addressed in each lecture.

When the programme was developed Introduction to Programming was included as part of Quantitative Methods, however it was overly ambitious for students to learn Python and Quantitative Methods within one module, consequently programming knowledge is assumed and not part of this module. The module and assessment are designed in a logical manner to instil a core quantitative base and create independent research capacity. Firstly, students are required to apply taught methods through a short, written investigation using supplied data (3a). In the next stage students work together to identity a new data set and then apply methods so summarise, communicate and visualise its key features (2c). Finally, students are required to use their previously assessed skills to independently develop a quantitative written investigation exploring a research question of their choice (2a, c, 3d, 4e). The module contributes to the quantitative skillset (A2) and methodological trends (A3) programme aims alongside a range of RGS criteria including originality and sound judgement (2) and transferable skills (4).

Term 1 modules aim to provide a foundation in city theory, geographical data, programming and quantitative methods that are furthered with more advanced methods and techniques in term 2 and subsequently applied and expanded upon within the final dissertation module.

Table 1: Term 1 module alignment summary with programme aims and learning outcomes alongside RGS criteria

Module	Programme aims	Programme learning outcomes	Main RGS criteria	RBS sub criteria
Urban Systems Theory	Experience a broad range of theoretical perspectives on the demographics, economics, form, function, network interactions, governance, policy, planning and, crucially, science of cities across the World (A1).	K1, 3 S2, 6 T5	A specialist and detailed understanding and critical awareness of contemporary geographical issues at, or informed by, the forefront of a geographical academic sub-discipline, field of study or area of professional practice (1).	1a-d 2a
Geographical Information Systems	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of smart city data leading to data-informed decisions (A2). Combine the taught material, academic expertise and personal research interests to develop an independent and unique research project into a pertinent and applied urban-centric topic (A5).	K2 S1-6 T3-4	Originality and sound judgement in the application of knowledge to solve geographical problems, together with an advanced practical understanding of how established methods of research and enquiry are used to create and interpret knowledge within the discipline (2). A comprehensive understanding of the diversity of geographical skills, techniques, methods and practical applications, concepts and theories applicable to research and advanced scholarship or professional practice (3).	2a-c 3a-d 4a, c, e
Introduction to Programming	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of smart city data leading to data-informed decisions (A2).	K3 S4-5 T2-T4	Originality and sound judgement in the application of knowledge to solve geographical problems, together with an advanced practical understanding of how established methods of research and enquiry are used to create and interpret knowledge within the discipline (2). A comprehensive understanding of the diversity of geographical skills, techniques, methods and practical applications, concepts and theories applicable to research and advanced scholarship or professional practice (3).	1a 2a, c 3a-d 4a, c,d-e

			The qualities and transferable skills necessary for employment (4).	
Quantitative Methods	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of smart city data leading to data-informed decisions (A2). Explore emerging technological innovations, methodologies and theories in cities across the Globe to tackle fundamental governance and sustainability problems facing the urbanised World (A3).	K2 S2, 5 T1, 3-5	Originality and sound judgement in the application of knowledge to solve geographical problems, together with an advanced practical understanding of how established methods of research and enquiry are used to create and interpret knowledge within the discipline (2). The qualities and transferable skills necessary for employment (4).	1c, d 2a-c 3a, d 4e

1.2 Term 2

The term 2 core theory module is entitled Smart Cities: Context, Policy and Governance, building up on Urban Systems Theory, the module explores the concepts, policy contexts and components of smart cities. Here, the discussion shifts to the role of information technology, modern computing and innovation alongside governance structures, ideologies and notions of citizenship in shaping smart city initiatives (1a, b). Students are introduced to a wide range of experts from different areas all dealing with smart cities in the most generic sense of the word (1c). Content is presented in weekly two hours lectures, with the first five lectures delivered by the module leader, covering the smart city discourse, norms and standards in relation to the key stakeholders and citizen-centric smart governance. Consideration is given to the ethical use of (open) data in strategic smart urbanism, and what theoretical and practical questions arise from it (2c, 4d). In the same theme as Urban Systems Theory, a weekly annotated bibliography (provided within the supplementary folder) concisely summarises key topics from the first five lectures. The last five lectures are delivered from academic staff members and post-doctoral researchers within the department covering the history of information technology, smart city technological systems and components (such as sensors, Internet of Things and smart lighting) and smart cities in action, with London as a case study (1b).

Whilst the assessment is individual, students are divided into three groups, with each group being assigned either Helsinki, Birmingham or Montreal as a case study. The first two tasks require students to respond to and reflect upon specific questions based on the smart city initiatives for their city. For the final assessment task students must propose their own new smart policy or solution using a theoretical or analytical concept from the module, again for their case study city (2 a, b, c, 4c, e). The effect of the module develops a critical engagement with smart city initiatives, challenges and opportunities that is essential in informing and directing the final dissertation. The module contributes to the theoretical perspectives (A1), emerging technological city innovation (A3), and critique of commonly used urban analytic buzzwords and fleeting methodological programme aims (A4). It also aligns with a

range of RGS criteria including: critical awareness of contemporary geographical issues (1), originality and sound judgement (2) and transferable skills (4).

The remaining taught modules of Urban Simulation and Spatial Data Capture, Storage and Analysis, progress the quantitative content and knowledge from Geographical Information Systems and Science, Quantitative Methods and Introduction to Programming. With both term 2 modules heavily featuring: programming, spatial data and processing, advanced mathematical models, spatial data storage and visualisation methods.

Urban Simulation explores spatial interaction and networks to build models that simulate processes in urban systems. It examines how urban systems and processes (e.g. from Urban Systems Theory) can be modelled from the perspective of complexity science (3a). The module has a specific focus on transport systems, centrality measures and community detection in social systems through modelling flows of commuting and migration patterns. It is divided into two main parts around the University wide reading week, but overall holistically explores the idea of flows and the networks they sit on. The first five lectures introduce urban and regional modelling, spatial interaction models, cellular automata and some agent-based modelling – the flows. The second part of the module moves to focus on the networks, looking at processes through nodes and interacting links.

The module is delivered through a weekly two hour lecture and an hour long practical session where the theory provided within the lecture is explored in Python. During the current academic year the practical material was re-written from R to Python, however access to the practicals in both languages is provided and either can be used for the assessment. The assessment of the module is a single task divided into two parts. The first requires students to use the practical material to implement three different centrality measures for London’s underground network. For each measure nodes must be removed in both a sequential and non-sequential manner, evaluated and then critically discussed (3c-d). In the second part of the assessment students are provided with a symbolic population and a number of jobs for each underground station. Two scenarios are presented (e.g. percentage

decrease in jobs at certain stations) and they must assess the redistribution of flows as if they were acting as a Transport for London consultant (2a-c). The content requires an understanding of spatial data (from Geographic Information Systems and Science), urban system theory (from the Urban System Theory model), programming (from Introduction to Programming) and models (from Quantitative Methods). The effect of the module develops an ability to implement interaction and network models to conduct analysis (e.g. resilience analysis) that students might be tasked with in future employment (4b). The module contributes to the quantitative spatial analytics skillset (A2) and emerging methodological aims (A3) alongside the RGS criteria of originality and sound judgement (2) and geographical skills (3).

Until this point the majority of modules detailed progress from subject to case/problem and then finally inquiry content and assessments (see section 3.5.3 for the programme assessment matrix). The overarching theme of this is to build research capacity within our students guiding and introducing them to core concepts (subject), which are demonstrated in applied examples (case/problem), with students then applying this knowledge to new scenarios and questions (inquiry) (Kahn and O'Rourke, 2005; Kwan, 2009). This not only follows Bloom's taxonym from low order to high order skills but directly aligns with UCL's research and educational framework (the connected curriculum) in which modules at the University are encouraged to facilitate learning through research and inquiry, preparing students for their dissertation project (Butcher et al., 2006; Fung, 2017).

Table 2: Term 2 module alignment summary with programme aims and learning outcomes alongside RGS criteria

Module	Programme aims	Programme learning outcomes	Main RGS criteria	RBS sub criteria
Smart Cities Context Policy and Governance	Experience a broad range of theoretical perspectives on the demographics, economics, form, function, network interactions, governance, policy, planning and, crucially, science of cities across the World (A1). Explore emerging technological innovations, methodologies and theories in cities across the Globe to tackle fundamental governance and sustainability problems facing the urbanised World (A3). Empower students to critically engage with commonly used urban analytic buzzwords and fleeting methodological trends in urban governance, providing confidence in responding to technological transitions and a robust foundation for future employment (A4).	K2, 3 S2-3, S6 T4-5	A specialist and detailed understanding and critical awareness of contemporary geographical issues at, or informed by, the forefront of a geographical academic sub-discipline, field of study or area of professional practice (1). Originality and sound judgement in the application of knowledge to solve geographical problems, together with an advanced practical understanding of how established methods of research and enquiry are used to create and interpret knowledge within the discipline (2). The qualities and transferable skills necessary for employment (4).	1a-c 2a-c 4c-e
Urban Simulation	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of smart city data leading to data-informed decisions (A2). Explore emerging technological innovations, methodologies and theories in cities across the Globe to tackle fundamental governance and sustainability problems facing the urbanised World (A3).	K1, 3 S1, 3, 4, 6 T4	Originality and sound judgement in the application of knowledge to solve geographical problems, together with an advanced practical understanding of how established methods of research and enquiry are used to create and interpret knowledge within the discipline (2). A comprehensive understanding of the diversity of geographical skills, techniques, methods and practical applications, concepts and theories applicable to research and advanced scholarship or professional practice (3).	3a,c-d 2a-c 4b

1.3 Term 2/3

Spatial Data Capture, Storage and Analysis is the only thirty credit module within the programme, running throughout term 2 and at the start of term 3. It provides students with both the technical and critical skills required for the treatment, analysis and presentation of spatial datasets. As opposed to other quantitative skill modules that are largely based on raw skills such as geographic data, programming, quantitative or simulation methods the focus here is on workflows for handling data for analysis, visualisation and dissemination (2a, c). The module is divided into three parts: (1) database concepts and techniques (2) practical data science and analysis skills and finally (3) interactive web visualisation.

Students learn about the complete data science workflow to extract, analyse and present results to a general audience through a website, as opposed to other modules that primarily consider policy or academic contributions and debates. The module is run over twenty weeks, with term 2 being composed of ten one hour lectures and ten two practicals and term 3 composed of group work and staff drop in sessions on topics requested by students. Students complement their existing knowledge of Python and acquire additional skills in other languages such as SQL, HTML and JavaScript.

Assessment is undertaken in groups where students must develop an interactive website that conveys deep analysis and insights drawn (3a, b, c, d) from one or more datasets (2a, c, 4e). Groups present their initial idea for their website in a formative presentation, with the website itself forming 60% of final grade, a final group presentation demonstrating the site; 10%, and a group report detailing the design, development, and execution of the project; 30%. A short individual personal reflection is required but not assessed (4a). The effect of the module allows students to work together in a team environment to design and complete a holistic data science project for a general audience, drawing upon and adding to existing knowledge from other modules. The module really contributes to all programme aims due it’s focus on appropriately handling, presenting and conveying meaning from data using additional analytic skills and developing research projects. It also aligns

with a range of RGS criteria including: solving geographical problems (2), geographical skills and practical applications (3) and transferable skills (4).

The final sixty credit dissertation module gives students an opportunity for supported, independent study[2]. They are able to freely demonstrate their ability to formulate and investigate an urban-centric study of particular personal interest. Students analyse and present the findings of their investigation, exhibiting and advancing skills and techniques they have learnt throughout the programme as an original piece of writing of around 10,000 words.

A series or ten lectures is provided in term 2, half of which are delivered by the module convenor and the other half by guest speakers. Lectures commence with an initial introduction to a dissertation in the first week with subsequent sessions exploring: proposal writing, tricks of the (research) trade (from Professor Sir Alan Wilson), UCL research ethics (4d), dissecting a CASA dissertation (from former MSc students), dissertation structure and study advice, and question and answer sessions. As part of the lecture series a week is dedicated to student drop in sessions, with students able to book a member of staff to discuss their idea for initial feedback prior to submitting their proposal.

The module is supplemented by additional presentations from a range of external partners who advertise projects to our students through academic staff within the department and external research centres such as the MSc Consumer Data Research Centre (CDRC). This will be further explored in the second part of the application. In a similar manner academic staff are encouraged to propose their own project briefs that students can apply for. At the end of term 2 students are required to submit a short dissertation proposal that also acts as an application for some external and internally advertised projects. The main purpose of the proposal is to: allocate students a supervisor, allocate students to advertised projects, establish if

[2] The dissertation module is taught to all CASA students (MSc / MRes SDSV and MSc SCUA and RTPI) at the same time with different criterion weighting in the mark scheme dependent on programme.

projects require ethical approval and ensure all students have an idea that is suitable for an MSc dissertation. Before term 3 students are assigned to a supervisor and they will commonly have around five meetings and written feedback on several chapters before submission. However, it is the responsibility of the student to manage the research project, following provided guidance (within the lectures and handbook provided in the supplementary folder). The module draws together all programme aims in achieving aim five, developing an independent and unique research project (A5). Similarly, due to the requirements of the module students often display the majority of the listed RGS criteria from identifying critical geographical issues, dealing with complex data, literature and methods to critically appraising results in relation to policy whilst continually making decisions, learning independently and creating innovative solutions to existing problems. This is especially evident given the success of our students in RGS research group awards over the last two years, where all those submitted have either won or jointly won the award they were nominated for (Table 3).

Table 3: RGS student dissertation award successes.

Student	RGS award	Year	Degree	Supervisor	GitHub
Cheyne Campbell	Planning and Environment	2020	Smart Cities and Urban Analytics	Dr Andrew MacLachlan	https://github.com/cheynecampbell/charlotte-pedestrian-safety
Hussein Mahfouz	GIScience (joint)	2020	Smart Cities and Urban Analytics	Dr Elsa Arcuate	https://github.com/Hussein-Mahfouz/Bicycle-Network-Optimization
Jamie Ser Nee Tan	Population Geography	2020	Smart Cities and Urban Analytics	Dr Jens Kandt	https://github.com/jamietanserneee/sg-heritage-gentrification
Greg Slater	Planning and Environment	2019	Spatial Data Science and Visualisation	Dr Thomas Oléron-Evans	Scripts in thesis
Thomas Keel	GIScience (joint)	2019	Spatial Data Science and Visualisation	Dr Huanfa Chen	https://github.com/Thomasjkeel/MSc_Dissertation
Joshua Yee	Population Geography	2019	Smart Cities and Urban Analytics	Dr Adam Dennett	https://jytg17.github.io/Unpacking-the-Nuances-of-Londons-Neighbourhood-Change-Gentrification-Trajectories/

Whilst it is important to recognise this success and the commitment of our students in achieving this, recent comments from the external examiner (that will be expanded in the next section) have specifically commended the excellent dissertation information, support and feedback, recognising that even in the lowest scoring dissertations the structure was considered to be of a good level and a credit to the academic staff.

Table 4: Term 2/3 module alignment summary with programme aims and learning outcomes alongside RGS criteria

Module	Programme aims	Programme learning outcomes	Main RGS criteria	RBS sub criteria
Spatial Data Capture, Storage and Analysis	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of smart city data leading to data-informed decisions (A2). Explore emerging technological innovations, methodologies and theories in cities across the Globe to tackle fundamental governance and sustainability problems facing the urbanised World (A3). Empower students to critically engage with commonly used urban analytic buzzwords and fleeting methodological trends in urban governance, providing confidence in responding to technological transitions and a robust foundation for future employment (A4).	S1,3-4 T1-4	Originality and sound judgement in the application of knowledge to solve geographical problems, together with an advanced practical understanding of how established methods of research and enquiry are used to create and interpret knowledge within the discipline (2). A comprehensive understanding of the diversity of geographical skills, techniques, methods and practical applications, concepts and theories applicable to research and advanced scholarship or professional practice (3). The qualities and transferable skills necessary for employment (4).	2a, c 3a-d 4a,e
Dissertation	Combine the taught material, academic expertise and personal research interests to develop an independent and unique research project into a pertinent and applied urban-centric topic (A5).	K1-4 S1-5 T2-6	The majority of RGS criteria are demonstrated in the dissertation module, see written explanation for further detail.	Majority

1.4 Maintaining standards

The programme contains multiple feedback points within the year and undergoes regular internal and external validation to ensure that the content, delivery choices, assessment methods and student outcomes are rigorous, robust and of high quality.

1.4.1 Staff development

Academic staff members are strongly encouraged, and in some cases required to complete UCL's teaching qualification, Arena 2. This qualification ensures that staff are able to effectively deliver content using current pedagogical approaches connecting students to our research, associated tools, methods and appropriate dissemination formats. On successful completion staff are entitled to Fellowship of the Higher Education Academy (FHEA). Similarly, current teaching assistants (doctoral candidates) are supported to take Arena Open to gain Associate Fellowship of the Higher Education Academy (AHEA), adding to their academic skillset. Arena also run and advertise internal and external (e.g. Transforming Assessment) training sessions on topics including: plagiarism, contract cheating and supervision. Full details of current programme staff accreditation are provided in section 3.5.2.

1.4.2 Continual programme improvement

Academic staff regularly review module content at the programme level, usually during the summer period, to ensure that our students are aware of and learning emerging techniques and theories. Currently this is managed through a shared online Miro whiteboard. The introduction of this approach last year by the departmental taught graduate tutor resulted in modules adjusting content to better complement each other and enabled specific reference to material covered elsewhere, throughout the programme.

In response to feedback from students requesting opportunities to test their knowledge with different examples and to identify areas requiring further explanation prior to summative assessments the programme lead was recently awarded UCL changemaker funding. The successful project aims to develop an interactive weekly

quiz tool to reinforce taught concepts and align module learning outcomes with programme aims, all being discussed in a short weekly seminar. It is hoped that this will be completed and in place for the coming academic year.

1.4.3 Internal Quality Review

UCL requires departments to complete an Internal Quality Review (IQR), a rolling six-yearly cycle programme of peer review. The department submits a self-evaluative statement with supporting documentation that is scrutinised by a panel of internal and external staff examiners. The panel visits the department and conducts interviews with staff and students. The last IQR (provided within the supplementary folder) was held in 2017 and the department received overall positive feedback, with the panel commending innovations in the discipline and programme design. No actions were directed towards specific module design or content, with the majority applicable to SUCA suggesting diversifying assessment methods (instead of essays) and adhering to UCL feedback timeframes. Based on the evidence provided within this document these recommendations have been implemented successfully.

1.4.4 Postgraduate Taught Experience Survey

Our students are asked to respond to the annual Postgraduate Taught Experience Survey (PTES). From the 2020 results the department scored relatively highly in relation to other departments within the Faculty and the University, with staff enthusiasm (87%) and intellect stimulation (100%) being particular highlights (see the supplementary folder for PTES results).

1.4.5 Annual Student Experience Review

Each year the department participates in the Annual Student Experience Review (ASER) process drawing together quality enhancement and monitoring activities that extend throughout the year (data review, external examiner reports, Postgraduate Taught Experience Survey (PTES) action planning, Staff Student Consultation Committee (SSCC) actions) into an annual health check (provided in the supplementary folder). The ASER is an opportunity to reflect on progress against education improvement objectives identified in the previous year and to develop an education enhancement plan for the coming year that is based on a range of

evidence and produced in partnership with student representatives. Current live objectives from the ASER include: diversifying the student cohort, signposting faculty level events, holding additional career events and revising modules to include more non-western literature and concepts.

1.4.6 External examination

Prior to each exam board the external examiner reviews every module (including assessment samples) and produces an annual report that the programme lead responds to (see the supplementary folder). All assessment moderation within department adheres to the UCL academic manual marking and moderation requirements with external examiners able to assess the process of marking and how final agreed grades are reached. In the case of disagreement for dissertations the department have created a marking scenario protocol for resolution and documentation purposes.

Considering the reports from the last three years issues including testing critical appraisal (Urban Simulation), module consistency and the dissertation mark scheme have been raised and addressed (see the supplementary folder for the old and new mark scheme). The new dissertation mark scheme revised grade descriptions in accordance with QAA framework with additional analytical judgements where appropriate (Dawson, 2017; QAA, 2014). In the most recent report no areas of concerned were raised with the dissertation staff and mark scheme being commended, and a version of the new mark scheme being adopted by the external examiner's institution. Nevertheless, there are internal concerns (as noted within the 2020 external examiner response), such as attainment gaps and clustering of lower grades on some modules. The departmental staff are currently discussing these issues at fortnightly teaching meetings and developing strategies to improve outcomes. External examiner reports and responses for the last three years are provided in the supplementary folder.

1.4.7 Term time student feeback

During the academic year there are two formal opportunities for students to give rolling feedback: module Opinio surveys and through representation at the termly

Staff Student Consultation Committee (SSCC). 2020-2021 term 1 survey results have been provided in the submitted supplementary folder and were largely positive with the respondents commending the teaching environment and module content. Student involvement within the SSCC has permitted identification of key initiatives in modules that have worked well and could be adapted to others. For example, students found the buddy scheme in Geographic Information Systems and Science effective and requested it for Spatial Data Capture, Storage and Analysis, with the module leader able to implement the request in time for the assessment.

In addition several modules contain mechanisms for continuous informal and anonymous feedback such as the use of Padlet in Introduction to Programming and Quantitative Methods and a weekly Google form in Geographic Information Systems and Science (located at the bottom of each practical). These channels allow students to identify concerns, giving instructors a broad overview of understanding and an opportunity to revisit and further explain raised concepts prior to assessments.

Over the past six years our students have nominated staff members for twelve UCL student choice teaching awards (detailed within section 3.5.1) being representative of both staff dedication to the programme and student satisfaction.

2 Professional practice

2.1 Employability attributes

The programme aims to provide students with the skills they need to succeed in professional and academic career paths after graduation. As evident in the module reflections in relation to the RGS criteria and programme aims our students gain key quantitative and practical skills such as programming and methodological techniques whilst being able to contextualise these within policy debates and literature around smart cities. This mix of theory and applied, cutting edge methods was praised in the latest external examiner report. The department continues to work closely with our external examiners, industry professionals and former students through our very active alumni network in ensuring our content is up to date, relevant and always applied to current challenges.

2.2 External engagement

Throughout Government reports and academic literature core knowledge of a subject has been found to not guarantee employment (Crebert et al., 2004). Whilst graduates may possess sufficient knowledge they can lack core skills required in industry (Hennemann and Liefner, 2010). Consequently, all CASA students have multiple opportunities to engage with external academics, industry and Government professionals through: information and data discussions sessions, sponsored dissertation projects, internal careers events with our alumni and weekly, public, term time seminars (and social events). As a result of the pandemic and moving all content online, in the last year a number of high-profile international speakers have presented their work at the seminar series, including, Shannon Mattern, Catherine D'Iganazio and Sarah Williams, with attendance often exceeding 200. Complementing the academic content, several seminars have also focused on employability and careers, for example, the CEO of Geolytix recently presented "Who I Want: Geolytix Talks Jobs". A full list of past and future seminars is available on the CASA events website.

Furthering the seminar series, extracurricular lectures have welcomed a variety of experts from industry and Government including: RStudio, UrbanDNA and the Ministry of Housing, Communities & Local Government. The latter of which ran an interactive workshop for our students engaging them with spatial questions around their new open datasets. These relationships provide an invaluable insight for the department into current analytical challenges faced by these institutions, allowing taught material to be adjusted to maintain relevance and applicability.

Based on relationships with invited seminar speakers, alumni, academic staff, industry collaborators, honorary staff and professional networking events (e.g. UCL's Community Research Initiative for Students (CRIS)) the academic staff have created a network of work integrated learning opportunities for our students as part of the dissertation module. Partner organisations submit project briefs (a Westminster council example is provided in the supplementary folder) that are advertised to all students, who apply for them via the dissertation proposal. If successful students have regular meetings with the partners and in some cases are permitted to be based in their office and become part of the team. During 2019-2020 we were able to offer all CASA dissertation students a choice of 61 projects from 28 organisations. One excellent success story from last year was CASA's work with Westminster Council that won a Cabinet Office Geospatial Commission Geography in Government Award in Excellence in Local Government.

Students are also encouraged to seek their own partnerships through external schemes (e.g. the CDRC), seminar speakers or other events that are widely advertised such as the LondonR group and humanitarian mapping community (e.g. Missing Maps and OpenStreetMap Team). The external engagement opportunities transitions participating students from working individually / with peers, to become active members of a professional community in which their projects can have actionable and meaningful outputs (Jackson, 2015). Last year a fantastic collaborative dissertation project was produced as a direct result of a student attending these events (with input from Médecins Sans Frontières), entitled Data Production and Maintenance in Humanitarian Mapping Campaigns, with the student securing related employment with Map Action.

Whilst multiple modules (previously explored) have detailed the skills acquired for individual and group project planning and management (e.g. Geographic Information Systems and Science, Quantitative Methods and Spatial Data Capture, Storage and Analysis) the dissertation module consists of a more substantial individual responsibility in project management. Students are provided with specific lectures on managing their project from academic staff and former students along with comprehensive guidance in the dissertation handbook including a suggested timeline of activities (see the supplementary folder). Students present their dissertation plan in supervision sessions, with supervisors monitoring progress throughout the dissertation period. In the latest external examination report the dissertation information provided to students was described as excellent. Nevertheless, a current concern among staff is the limited external engagement opportunities students have to showcase their work (e.g. for future employment). Consequently the module leader has recently created a CASA MSc thesis bookdown template (https://andrewmaclachlan.github.io/CASA-MSc-thesis/) enabling students to produce a CASA formatted pdf (via the download button) and a website from the same RMarkdown documents (Xie, 2016).

2.2.1 Future opportunities

In 2020 the programme lead was awarded a UCL Middle East and Africa teaching grant to collaborate with the Geomatics Division at the University of Cape Town (currently suspended due to the pandemic). In addition, from our former students we have links to the Policy and Strategy department at City of Cape Town and it is hoped that the visit can bring all institutions together for collaborative training that could lead to future multi-institutional and external MSc student projects.

2.3 Careers

All students are supported with their career and professional planning in two complimentary strands throughout the academic year, one provided externally by the UCL careers consultant and one internally by the careers and alumni officer, currently Dr Andrew MacLachlan. The UCL careers consultant runs a lecture in induction week and one in each term covering steps for securing employment post-graduation as well as individual guidance through bookable sessions.

The main internal careers departmental event of the year is the CASA alumni network panel, where former students at various stages of their career are invited to discuss and reflect upon key questions. The event last ran in December 2020 and included topics such as: essential skills acquired during their degree, advice they would give themselves looking back and how they overcame career challenges. The event is run informally with food and drinks during breaks to encourage networking of the current cohort with the alumni network. Several of the alumni network (e.g. our Westminster Council contact) also propose dissertation projects, meaning students can benefit from their first-hand experience completing the degree, securing employment and progressing on a smart cities related career path. The response from students to these events is always very positive, with the PTES indicating that CASA is above the UCL average for student identified employability skills and career preparedness.

3 Supporting evidence

3.1 Programme summary

Programme title:	MSc Smart Cities and Urban Analytics
Routes:	• TMSARCSSCU01 - MSc Smart Cities and Urban Analytics • TMSARCSSCR01 - MSc Smart Cities and Urban Analytics (RTPI Pathway)
Pathways:	N/A
Cognate programmes:	N/A
Portico programme code:	TMSARCSSCU01
UCAS code:	N/A
HECoS Code(s)[3]:	100666 - Urban geography 100402 - Mathematical Modelling 100369 - Geographical Information Systems
Source of funding:	HE Funding Council For England
Faculty:	Faculty of the Built Environment
Department:	Centre for Advanced Spatial Analysis
Programme leader:	Dr Andrew MacLachlan

[3] HECoS codes are 6-digit numeric codes and the full list is available at: https://www.hesa.ac.uk/innovation/hecos via the button marked “View the HECoS Vocabulary”. If HECoS Code(s) are not provided on this form, they will be assigned by Student and Registry Services on the basis of the description in this programme summary.

Admissions tutor:	Dr Andrew MacLachlan, Dr Valerio Signorelli, Dr Adam Dennett, Dr Huanfa Chen, Dr Martin De-Jode
Programme administrator:	Ms Sonja Curtis
Department email address:	casa-teaching@ucl.ac.uk
Department/programme website:	https://www.ucl.ac.uk/bartlett/casa/
Board of examiners:	MSc Built Environment Examination Board
Board of examiners Portico code:	ARCHGBUENV
Accessibility: Give details of any specific physical or other requirements of the programme that might present difficulties for a disabled student:	N/A
Chair of board of examiners:	Dr Matthew Davies

3.1.1 Awards

Final qualification:	Master of Science (MSc)
Field(s) of study:	Smart cities, quantitative analysis, policy, spatial data
Volume and level of credit required for qualification:	180 credits at level 7
Qualification level:	FHEQ Level 7

3.1.1.1 Interim qualification(s)

Interim qualifications are lesser awards made as a result of the student either leaving a programme early or failing to meet the requirements for the intended award but still being eligible for the award of a lesser UCL degree.

Qualification	Level	Credits required	Alternative field(s) of study	Type of Qualification	Classified?
Postgraduate Diploma (PG Dip)	7	120 credits at level 7		Interim/Exit (not an advertised outcome)	No
Postgraduate Certificate (PG Cert)	7	60 credits at level 7		Interim/Exit (not an advertised outcome)	No

3.1.1.2 Alternative qualification(s)

Alternative qualifications are those offered at the same level as the intended qualification but offered to students who do not meet additional requirements (e.g. a student who fails to meet the requirement for professional accreditation but has met the minimum UCL threshold standard and is able to receive an alternative degree).

Qualification	Level	Credits required	Alternative field(s) of study	Type of Qualification	Classified?
There are no alternative qualifications on this programme					

3.1.2 Mode of study

Modes of attendance offered and duration of study at that mode:	• Full-time: 1 calendar year • Part-time: 2 calendar years • Modular flexible: 5 calendar years
Location of study:	Campus-based

At which campus is the majority of programme delivered?	Bloomsbury Campus

3.1.3 Accreditation, regulation, and collaboration

Regulatory body:	
Professional accreditation:	Applying for Royal Geographical Society accreditation
Does the programme lead to the award of Qualified Teacher Status (QTS)?	No
For programmes leading to QTS which is the institution/organisation which recommends students for QTS?	N/A
For teaching training programmes, what is the scope (age range) of teacher training?	N/A
Dual, double, or joint degree awarding institution(s):	N/A
Collaborating organisations:	No collaborating organisation
Is the programme a closed programme?	No

3.1.4 Programme description

Summary programme description:	The Smart Cities and Urban Analytics (SCUA) MSc programme equips students with advanced, multi-disciplinary, and critical data-informed approaches for understanding, monitoring and improving global city resilience and sustainability. Taught content explores the theoretical, social and scientific foundations of the modern built environment through a geo-spatial, data-oriented lens. We provide students with a practical appreciation of the technical and methodological state-of-the-art tools associated with analytics and data-driven urban decision making, including: mathematical and statistical modelling, computer programming, spatial analysis and cartographic visualisation. Importantly, these practical skills are underpinned by broad theoretical perspectives on the demographics, economics, form, function, network interactions, governance, policy, planning and crucially science. The programme is deliberately cross-disciplinary, drawing on staff with backgrounds in geography, planning, computer science, physics, as well as the arts and humanities. Consequently, we do not require a specific undergraduate degree, only a 2:1 classification or equivalent; this encourages creative thinking whilst recognising the wide range of degrees and prior employment that could be developed with a SCUA MSc. All material is taught under the assumption of no prior knowledge that informs the programme aims and learning outcomes. Through learning what is possible; the benefits and importantly the limitations of the next urban digital trend, our graduates stand out as experts able to transcend the hype

	and buzz that frequently accompanies the mention of smart cities.
Outline programme structure:	Students undertake modules to the value of 180 credits. The programme consists of six core modules, with one optional module (120 credits), and a final dissertation (60 credits).
Employability Summary/Graduate Attributes:	This programme provides students with the skills and knowledge base to embark on a professional or academic path through the highly interdisciplinary field of urban analytics and spatial science (see the summary programme description and learning outcomes for specific skills). Since its inception in 2013, SUCA graduates have gone on to pursue a wide variety of careers in local government, urban planning, software development and academic research. This is indicative of the breadth of knowledge and opportunities afforded by our programme.
Alumni information:	Students have access to termly University and departmental career events, that latter of which involve our active alumni network.

3.1.5 Learning and assessment

Teaching and Learning methods/strategies:	The modules on the programme are delivered through a combination of different teaching and learning activities. Lectures feature widely, as do computer-based practical classes, tutorials and student and teacher led discussion groups. Self-study is expected throughout the programme. In addition to formal teaching, students can learn directly from experts in the built environment and spatial analysis through the weekly term time CASA seminar series.

Academic Partnerships: Is the programme or any part of programme taught at the premises of an external organisation to UCL:	As part of the dissertation module students may have opportunities to collaboratively work with external organisations on dissertation projects. Usually this involves meeting in the partner's office, but on occasion students have been allocated a work space, usually when data access is required. However, this is not a requirement of any dissertation project or the module and is on a case by case basis.
Programme learning outcomes:	**Programme aims** The purpose of the programme is to: • Experience a broad range of theoretical perspectives on the demographics, economics, form, function, network interactions, governance, policy, planning and, crucially, science of cities across the World (A1). • Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of smart city data leading to data-informed decisions (A2). • Explore emerging technological innovations, methodologies and theories in cities across the Globe to tackle fundamental governance and sustainability problems facing the urbanised World (A3). • Empower students to critically engage with commonly used urban analytic buzzwords and fleeting methodological trends in urban governance, providing confidence in responding to technological transitions and a robust foundation for future employment (A4). • Combine the taught material, academic expertise and personal research interests to develop an independent

	and unique research project into a pertinent and applied urban-centric topic (A5). **Learning Outcomes** By the end of the programme students should be able to: **Knowledge and understanding** • Identify key urban system theories and discuss their relationship to contemporary challenges (K1). • Outline topical global urban problems alongside recent methodological approaches and establish the validity of spatial analysis in furthering understanding (K2). • Critically debate and assess urban research in relation to methodological advancement and policy outcomes (K3). • Build upon module content and wider academic and policy literature in formulating independent, reproducible and original urban related research (K4). **Skills, techniques, methods and practical applications of concepts and theories** • Identify geo-spatial data sources and assess their applicability for urban focused studies (S1). • Explain, critique and implement relevant geo-spatial data formats, methodological approaches, tools, visualisations and packages in relation to appropriate theory (S2). • Propose smart, data-informed and appropriate solutions for Global cities (S3).

	• Write reproducible code to query databases, wrangle and summarise data, undertake geo-spatial analysis and produce appropriate audience orientated visualisations (S4). • Describe and evaluate competing urban data sources, methodologies, workflows and visualisations (S5). • Compose academically rigorous and robust reports with a flowing narrative, outlining debate, being interspersed with opinion, whilst highlighting research gaps (S6). **Transferable skills** • Work in a team from diverse educational and international backgrounds in achieving a common goal (T1). • Evaluate and make decisions at all stages of the typical spatial data science workflow in creating meaningful and robust outputs (T2). • Effectively source, wrangle, analyse data and appropriate communicate the results based on the intended audience (T3). • Realistically solve problems based on the available data, resource and expertise (T4). • Write balanced and concise reports that consider all evidence in reaching recommendations (T5). • Lead and manage an independent research project, in turn demonstrating time management, critical evaluation, ethical consideration and appropriate statistical methodologies (T6).

Interim award learning outcomes:	UCL standard learning outcomes as per the Academic Manual. Specifically section 12.11 for the Postgraduate Diploma and section 12.10 for the Postgraduate Certificate.
Details of the types of assessment undertaken as part of the programme:	Assessment is undertaken via a variety of means, including practical projects, group presentations, written technical coursework reports, essays, and a final research dissertation.
Subject benchmark statement:	No directly applicable subject benchmark statement

3.1.6 Progression, award, and classification

Details of any alternate marking scales:	N/A
Additional requirements for the achievement of professional accreditation:	N/A
Details of any alternate progression requirements:	N/A
Classification scheme:	The Taught Postgraduate Classification Scheme applies to this programme, the details can be found in the Assessment Framework for Taught Programmes in Chapter 4 of the Academic Manual section 10.6.

3.1.7 Modules (programme diet)

Details of modules available on the programme (including those which are compulsory):	**Compulsory modules** • Geographic Information Systems and Science (15 credits) – term 1 • Quantitative Methods (15 credits) – term 1 • Urban Systems Theory (15 credits) – term 1 • Smart Cities: Context, Policy and Government (15 credits) – term 2 • Urban Simulation (15 credits) – term 2 • Spatial Data Capture, Storage and Analysis (30 credits) – term 2/3 • MSc Smart Cities Dissertation (60 credits)- term 3 **Optional modules** • Introduction to Programming for Spatial Analysts (15 credits) – term 1 • Agent Based Modelling for Spatial Systems (15 credits) – term 2 Or any other 15-credit module across UCL, subject to availability and the permission of the home and teaching department.
Details of any modules and/or components which are non-condonable (including rationale):	N/A

3.1.8 Admissions

UCAS Keywords:	N/A
Entry criteria:	This programme requires: An equivalent of a 2:1

	A standard level of English
Recognition of Prior Learning (RPL)	N/A
DBS/Occupational Health/Fitness to Practice requirements:	N/A
Entry points (for programmes starting at times other than the beginning of term, please also indicate the expected start date):	September, annually
Details of any additional costs to students:	N/A

3.2 Module map

Terms at UCL run across eleven weeks, divided into two five week teaching blocks separated by a University wide reading week. The MSc Programme has a modular structure, with a requirement of 180 credits being composed of six mandatory modules (105 credits), one optional module (15 credits) and a mandatory dissertation (60 credits). A schematic representation of the structure of the programme and sequence of its modules with linkage to programme learning outcomes is shown in the accompanying diagram. Individual module descriptions are provided within section 3.3.

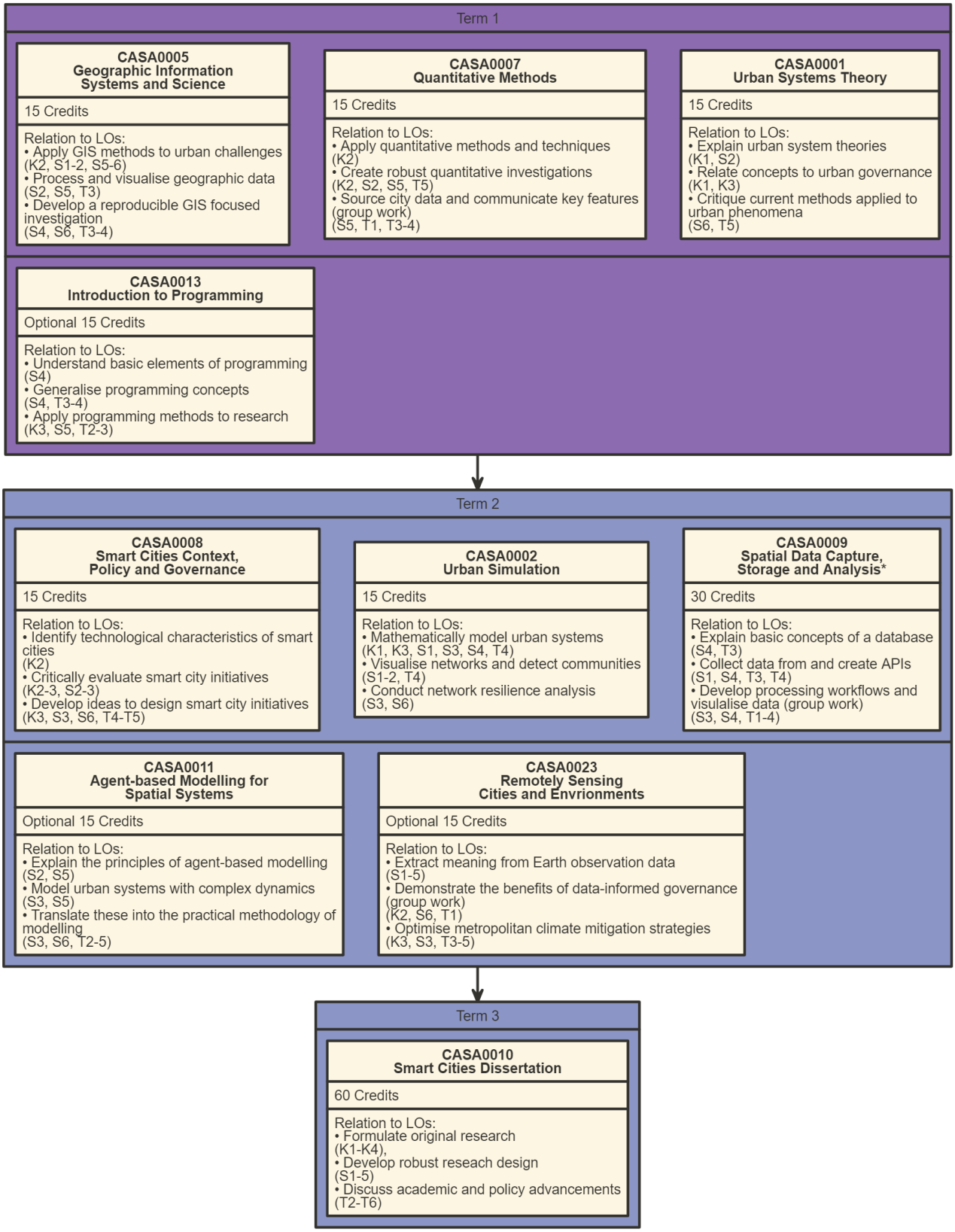

Figure 1: Schematic representation of the Smart Cities and Urban Analytics MSc structure per academic term. Modules under the horizontal line for each term time box are optional (e.g. CASA0011), with CASA0023 approved by UCL but still in development. The learning outcomes and codes (e.g. K1, S1, T1) refer to the relationship of the module to the programme learning outcomes specified within section 3.1.5. This diagram can viewed online along with the code developed to produce it. *Spatial Data Capture, Storage and Analysis runs over term 2 and 3.

3.3 Module summaries

3.3.1 Term 1 modules

3.3.1.1 Urban Systems Theory (CASA0001)

Module name	Urban Systems Theory
Module code	CASA0001
Credits	15
Compulsory	Yes
Term	1
Module description	This module provides a cross-disciplinary introduction to urban theory and science. We will discuss fundamental concepts and models developed by urban geographers, planners and social thinkers. Topics include urbanisation, systems and complexity theory, urban morphology, mobility, socio-spatial differentiation and their implications for urban governance and planning.
Module summary	The 'Urban Systems Theory' module contributes to the wider MSc programme by providing a social science foundation to the subject of urban analytics and smart cities. You will build up on the concepts discussed here in the term 2 module 'Smart Cities: Context, Policy and Government' and in your dissertation. We will practice scholarly research methods and critical, scientific engagement, all of which will help you prepare for careers in academia, government or industry.
Learning outcomes	By the end of the module students should be able to: • Apply social science concepts to urban systems. • Conceptualise the relationship between society and space. • Critically analyse diverse urban phenomena and debates.

	• Evaluate and design research inquiries into urban phenomena.
Contact	A weekly lecture (one hour)
Assessment	Students are divided into three assessment groups, each being set tasks after different lectures. They must complete three assessments tasks, two written responses on theoretical concepts (e.g. planetary urbanism, conceptions of space) and a final task in which they must develop a study outline, for any city, that investigates either (a) urban health disparities or (b) the impact of compact urban form on sustainability, using a theoretical concept from task one or two (2a). • Coursework 1, response question (800 words, 40%). • Coursework 2, response question (800 words, 40%). • Coursework 3, development of a study outline (400 words, 20%).
Module convenor	Dr Jens Kandt
Lecturers	Dr Elsa Arcaute, Professor Michael Batty

3.3.1.2 Geographic Information Systems and Science (CASA0005)

Module name	Geographic Information Systems and Science
Module code	CASA0005
Credits	15
Compulsory	Yes
Term	1
Module description	The purpose of this module is to equip students with an understanding of the principles underlying the conception, representation/measurement and analysis of spatial phenomena. As such, it presents an overview of the core organising concepts and techniques of Geographic Information Systems, and the software and analysis systems that are integral to their effective deployment in spatial analysis. It is concerned with unearthing and understanding the importance of spatial data in a range of contexts. The module is designed to have a large practical component in order that students can use the latest software and techniques to analyse and infer from contemporary datasets. The module is taught predominantly in R but also covers basic concepts in QGIS. The intention is that students will complete the course with a broad knowledge of spatial analysis which they can draw on for their dissertation and further study or employment.
Module summary	The module focuses on the principles underpinning geographic representation, geographic information science (GIScience) and spatial analysis using a range of GIS software. We present an overview of raster and vector spatial methodologies with outputs demonstrating recent developments in visualisation and interactive mapping techniques.
Learning outcomes	By the end of the module students should be able to:

	• Develop a working knowledge of QGIS and R to support the application of GI Science techniques. • Visualise geographic information through producing appropriate maps to high cartographic standards. • Carry out spatial data management tasks (joining attribute to geometry data, cleaning data, converting between file formats and spatial reference systems). • Interpret data and apply relevant spatial analyses (e.g. auto correlation/hot spot analysis, areal interpolation, point in polygon/buffer analysis) to answer a variety of spatial problems. • Explain and evaluate common issues with geographic data such as representation and uncertainty. • Apply and critique (spatial) statistical analysis techniques to infer relationships between spatial phenomena. • Experience the diversity of the global spatial data landscape and evaluate the relative drawbacks and merits of different spatial datasets.
Contact	A weekly lecture (one hour), workshop sessions (three hours) and postgraduate seminar sessions (for the last five weeks).
Assessment	A 3,000 word report (100%) that answers a pertinent or topical geo-spatial question/hypothesis/issue in a logical, scientific and reproducible manner.
Module convenor	Dr Andrew MacLachlan
Lecturers	Dr Adam Dennett

3.3.1.3 Introduction to programming (CASA0013)

Module name	Introduction to programming
Module code	CASA0013
Credits	15
Compulsory	No
Term	1
Module description	This module gives students an introduction to the basics of computer programming through simple material related to spatial analysis. The course focuses on how to make use of the tools presented here in a larger workflow. Throughout, students will discover how they can use what they learn here to support their research and studies.
Module summary	This module gives students an introduction to data analysis in the Python programming language through a mix discussion and coursework built around an applied spatial analysis problem. The module is intended to complement Quantitative Methods and Geographic Information Systems by showing concepts covered in those modules can be applied in a computational context as part of a larger piece of spatial data science analysis. You will often encounter concepts in this module that have been treated elsewhere, but should be looking for ways to reinforce and generalise your understanding. You will see how these are employed as part of a larger 'workflow' involving Exploratory Data Analysis in both non-spatial and spatial contexts, data transformation, visualisation, and interpretation. You will also see how to make use of tools, such as Markdown and GitHub, to tracking and manage both your notes and your programming files.

	Throughout, it is hoped that students will not only find ways to apply what they have learned here to support their research and studies, but also become familiar with core tools employed by practicing data scientists in ways that support post-graduation employment.
Learning outcomes	By the end of the module students should be able to: 1. Understand basic elements of programming, including: • Variables, methods, functions and classes. • Loops and conditionals. • Object orientation. 2. Be able to generalise from these concepts using code. 3. Explore how to use programming in order to achieve research aims, including: • Reading in, analysing, and exporting data. • Visualising information. • Combining different tools and techniques. • Be able to write code from scratch as well as by drawing on resources found online. • Be familiar with a data analytics workflow that makes use of code alone.
Contact	A weekly lecture /live coding session (two hours) and practical sessions (two hours)
Assessment	• A timed coding test (two hour test, 15%). • A data biography reflecting on Inside Airbnb data (1,050 words, 25%). • A data-led policy or marketing brief for either the Mayor of the Greater London Authority or the Chief Executive of an investment company on the challenges/opportunities relating to Airbnb's operations in London (2,500 words, 60%).

Module convenor	Dr Jon Reades
Lecturers	Dr Huanfa Chen

3.3.1.4 Quantitative Methods (CASA0007)

Module name	Quantitative Methods
Module code	CASA0007
Credits	15
Compulsory	Yes
Term	1
Module description	This Master's level module introduces students to a range of statistical and mathematical tools for analysing and interpreting data. The module also focuses on key skills, such as communicating data, writing technical reports, and approaching quantitative problems. Applications and examples concentrate on the field of cities research. Explanations are intended to develop conceptual understanding rather than technical mathematical frameworks. Little to no prior knowledge is assumed. This module is of most relevance to students from the social sciences or the field of cities research specifically who wish to develop their quantitative skills. It is not appropriate for students from outside the Centre for Advanced Spatial Analysis who already have significant technical training (e.g. a background in mathematics or the natural sciences). Content covered includes: fermi estimations, linear regression, hypothesis testing, clustering, linear programming, statistical fallacies, systems dynamics models.
Module summary	This module is designed to demonstrate the integral part that quantitative methods play in research. Students will be introduced to a range of quantitative approaches from the fields of statistics, modelling and data analysis, to serve as tools in their other disciplines. Throughout the course, the focus will be firmly on building conceptual understanding, rather than detailed mathematical manipulation.

Learning outcomes	By the end of the module students should be able to: • Encounter and develop an understanding of a broad range of quantitative techniques and concepts. • Be equipped to expand on and develop these skills through individual research. • Become confident in formulating a coherent quantitative argument, built around the results of the techniques encountered in the course.
Contact	Weekly lecture (three hours).
Assessment	• An investigation of the provided data using methods seen in the Quantitative Methods course (or by extending those methods) through a written report (1,000 words, 20%). • In groups of four, students must find a data set that is broadly related to cities research or spatial analysis. Considering methods from the course related to exploring, summarising and visualising data, communicate the key features of this data set through a ten minute presentation (20%). • A final written investigation using a research question of their choice and methods from the course (1,750 words, 60%).
Module convenor	Dr Huanfa Chen
Lecturers	Dr Hannah Fry

3.3.2 Term 2 modules

3.3.2.1 Smart Cities: Context, Policy and Government (CASA0008)

Module name	Smart Cities: Context, Policy and Government
Module code	CASA0008
Credits	15
Compulsory	Yes
Term	2
Module description	This module focuses on the societal and technological context of smart urbanism and develops a critical perspective on emerging smart city notions, key players and their practices, partnerships, urban digital strategies, infrastructure and analytics. Part of this will be an examination of how novel information technologies function and relate to social life and institutions in cities. NB: Students wishing to take this module should have taken CASA0001 Urban Systems Theory also.
Module summary	Building up on Urban Systems Theory, this module will focus on concepts, policy contexts and components of Smart Cities. We will discuss the role of information technology, modern computing and innovation alongside governance structures, ideologies and notions of citizenship in shaping Smart City initiatives.
Learning outcomes	By the end of the module students should be able to: • Identify salient spatial, technological and governance characteristics of smart cities. • Participate in a social science discourse on smart cities.

	• Critically analyse and evaluate smart city initiatives with respect to contents, sectors, governance and citizenship. • Develop ideas to design smart city initiatives.
Contact	Weekly lecture (one hour)
Assessment	Students are divided into three groups, with each group being assigned either Helsinki, Birmingham or Montreal as a case study. The first two tasks require students to respond to and reflect upon specific questions based on the smart city initiatives for their city. For the final assessment task students must propose their own new smart policy or solution based on a theoretical or analytical concept from the module, again for their case study city • Coursework 1, response question (800 words, 40%). • Coursework 2, response question (800 words, 40%). • Coursework 3, proposal of smart urban policy or solution (400 words, 20%).
Module convenor	Dr Jens Kandt
Lecturers	Dr Max Nathan, Professor Duncan Wilson, Dr Valerio Signorelli, Mr Oliver Dawkins, Professor Michael Batty

3.3.2.2 Urban Simulation (CASA0002)

Module name	Urban Simulation
Module code	CASA0002
Credits	15
Compulsory	Yes
Term	2
Module description	The module aims to introduce students to the mathematical modelling of urban systems within the framework of complexity science. Two main methodologies will be used: network science and spatial interaction models. In detail, students will learn to represent processes in urban systems, and to encode the connectivity, relationships between agents, locations or services, leading to the prediction of the emergent flows. The skills learnt in this course can be applied to a wide range of systems. During the course we will look at transport systems, centrality measures and community detection in social systems; and the modelling of flows related to commuting or migration patterns. There are no prerequisites for the course, nevertheless, the students possessing programming skills and basic linear algebra knowledge will be at an advantage. Codes needed for the practical workshops and assessment will be provided.
Module summary	This module will provide different methodologies, such as spatial interaction models and networks, to build models to simulate processes in urban systems, in particular those related to flows, such as commuting flows, and those related the relationships between agents, which can be locations, spaces, individuals or communities to name a few.
Learning outcomes	By the end of the module students should be able to:

	Part 1: • Construct a spatial interaction model of flows from a set of origins to a set of destinations in Python. • Calibrate the model using real data. • Select the appropriate model and the constraints given data availability and the spatial problem to solve. • Be aware of other modelling frameworks, such as ABM and CA. Part 2: • Construct and encode a network as a list of nodes and as an adjacency matrix. • Understand the difference between local and global properties of the network. • Compute centrality measures of the network. • Detect communities in a network. • Construct different links for the same nodes considering different characteristics. • Perform a resilience analysis on the network. • Construct and visualise a network that is embedded in space. • Visualise the networks and their different characteristics.
Contact	Weekly lecture (one hour) and practical (two hours).
Assessment	100% coursework (3,000 words) divided into two parts. Part 1 explores network centrality measures and the influence of removing network nodes from the London Underground. Part 2 uses a symbolic population and the number of jobs for the stations in the network to evaluate its resilience.
Module convenor	Dr Elsa Arcaute
Lecturers	Professor Michael Batty

3.3.2.3 Agent-based Modelling for Spatial Systems (CASA0011)

Module name	Agent-based Modelling for Spatial Systems
Module code	CASA0011
Credits	15
Compulsory	No
Term	2
Module description / summary	This module will introduce students to the design and use of agent-based models (ABMs) in a variety of urban analytical contexts. The course will employ a hands-on approach, with practical sessions guiding students through the construction of example models, building up to producing their own simulations and using them to conduct experiments. Themes covered in this module will include: • Cellular Automata. • Presenting ABMs using the Overview Design Detail (ODD) Protocol. • Modelling competition among agents. • Optimisation of ABM performance. • Using ABM to make forecasts and predictions. • Integration of ABM and GIS. The module will further cover the history and development of the field, as well as current trends, focusing particularly on the evaluation of model outcomes. It will address applications such as pedestrian movement, traffic and transportation, land use, evacuations and crises, and basic epidemiology.

	Models will be built using the specialist agent-modelling software NetLogo (or an appropriate alternative – adaptations may be made to keep the course current).
Learning outcomes	By the end of the module students should be able to: • Understand the principles of agent-based modelling (ABM). • Describe the type and range of systems to which ABM can be profitably and appropriately applied. • Conceptualise and model urban systems with complex dynamics. • Show evidence of being able to translate these understandings into the practical methodology of modelling.
Contact	Weekly lecture (one hour) and workshop (one hour)
Assessment	Three pieces of coursework: • Agent based modelling research proposal (500 words, 10%) • Agent based modelling systematic experimentation (1,000 words, 30%) • Development of an based model for the proposal submitted in the first assignment (1,500 words, 60%)
Module convenor	Dr Thomas Oléron-Evans
Lecturers	Dr Sarah Wise

3.3.3 Term 2 and 3 modules

3.3.3.1 Spatial Data Capture, Storage and Analysis (CASA0009)

Module name	Spatial Data Capture, Storage and Analysis
Module code	CASA0009
Credits	30
Compulsory	Yes
Term	2 and 3
Module description / summary	The purpose of this module is to provide students with both the technical and the critical skills required for the treatment, analysis and presentation of spatial datasets. In line with this objective, the course is divided into three main themes. In the first, database concepts and techniques are introduced, providing the students with the skills required for manipulating databases. SQL syntax will be taught in depth at this stage, with a strong emphasis on practical application. The second phase of the course moves towards covering the practical skills required in data handling and analysis. Students will first learn how to manage and validate raw, unprocessed data, before moving onto exploring methods for deriving deeper insight into trends in data. The third and final element of the course moves into the presentation of data, introducing web development practices that enable the interactive visualisation and interrogation of complex datasets. In this section of the course, students will learn the techniques necessary to take datasets from the database through to interactive analysis and visualisation.
Learning outcomes	By the end of the module students should be able to:

	• Understand basic concepts of a database and how to store and retrieve complex data from these systems. • Process and clean datasets downloaded from the web as well as critically think about the best practise and toolsets to use for each dataset. • Analyse data using various methods including regression, clustering and basic machine learning workflows. • Create an Interactive Website powered by JavaScript and styled in CSS to communicate your data visualisation to a wider audience. • Understand how to collect data from API's and how to create your own API to power an interactive website. • Create processing workflows to consume data feeds and CSV files and visualise the data for the web. • Critically assess your own and other visualisations based on best practises using basic Human Computer Interaction (HCI) principals and established User Experience Guidelines.
Contact	Weekly lecture (one hour) and workshops (two hours)
Assessment	In groups, students are required to develop an interactive website that conveys deep analysis and insights drawn from one or more datasets. The website should be designed with contemporary web development tools, should introduce advanced data analysis processes, and allow the user to gain a greater understanding of the subject being presented. This task represents 100% of the overall module assessment but is split into the following components: • A ten minute group project pitch (unassessed but required). • A group website demonstrating interactive visualisation and analysis of data (60%). • A fifteen minute group presentation of project (10%). • A group report detailing website creation, development and execution (5,000 words, 30%).

	• An individual personal reflection (500 words, unassessed but required).
Module convenor	Mr Steven Gray
Lecturers	Dr Huanfa Chen

3.3.3.2 Smart Cities Dissertation (CASA0010)

Module name	Smart Cities Dissertation
Module code	CASA0010
Credits	60
Compulsory	Yes
Term	Lectures in term 2, assessment in term 3
Module description	This module is based around the writing and preparation of an original research project in the form of a Master's Dissertation. Students will be required to plan the research and dissertation from an early stage with ongoing development building on both projects and taught courses developed through the year. The research topic will be defined under the guidance of the student's dissertation supervisor with the support of the Programme Director. The aim is to produce a unique, individual piece of work with an emphasis on data collection, analysis and visualisation linked to policy and social science orientated applications. Students may have an opportunity to collaborate with industry partners in the course of this module.
Module summary	This module will focus on the principles of conducting a substantial independent academic research project. It is one of the highlights of the year whereby you have total freedom to follow your spatial interests with guidance from academic and industry leaders.
Learning outcomes	By the end of the module students should be able to: • Formulate an original and novel research question applicable to the discipline of spatial analysis. • Describe, explain and synthesise literature and policy documents relevant to the research question and objectives.

	• Develop a robust research design demonstrating technical proficiency and advanced skills. • Describe and explain results with a clear and guiding narrative. • Critically reflect on findings and discuss the academic and or policy advancements from the research. • Construct and manage a substantial independent research project.
Contact	During term 2 there is a weekly lecture (one hour) and in term 3 individual supervision sessions (usually five per student)
Assessment	All Masters students are required to submit a dissertation as a major element of the work that they do towards their degree. The dissertation should present the findings of a programme of original research, the topic of which is chosen by the student in consultation with members of the academic staff in CASA (10-12,000 words).
Module convenor	Dr Andrew MacLachlan
Lecturers	Dr Martin De-Jode, Professor Sir Alan Wilson, Dr Duncan Smith

3.3.4 Approved modules in development

3.3.4.1 Remotely Sensing Cities and Environments (CASA0023)

Module name	Remotely Sensing Cities and Environments
Module code	CASA0023
Credits	15
Compulsory	No
Term	2
Module description	This module will enable students to operationalise remotely sensed Earth observation data for informing decisions on environmental hazards arising from a changing climate, specifically in relation to (a) urban areas and (b) future urban sustainability. Firstly, the module presents an overview of the core concepts, methods and practices used to pre-process imagery underlying the discipline. Building upon this, the content focuses on advanced methodologies to extract meaning from Earth observation data and combinations of spatial data. It will examine and provide specific applied examples of achievable local, national and international policy modifications to incorporate spatial data and analytical requirements allowing data-driven optimisation of resources, maximising investment, environmental and sustainability outcomes. The module has a large practical component that is primarily taught in the R data science programming language but also covers some specialist tools including cloud computing and opensource geographic information systems software. Students will gain an operational knowledge of Earth observation data that can be drawn upon in future research or employment.
Module summary	Students will be exposed to Earth observation data for developing spatially targeted and optimised climate mitigation strategies

	alongside reproducible workflows documented in online portfolio workbooks.
Learning outcomes	By the end of the module students should be able to: • Create a reproducible online portfolio workbook. • Explain and evaluate common issues with urban and environmental policies at the local, national and international level that fail to consider spatial data. • Revise vague and ambiguous development targets. • Appropriately pre-process Earth observation imagery ready for analysis. • Apply published methodologies to extract meaning from Earth observation data. • Combine a variety of spatial data to demonstrate the benefits of data-informed governance and planning. • Create and design a reproducible workflow for consistent monitoring of urban and environmental metrics. • Critique and optimise recently developed metropolitan climate mitigation strategies using appropriate spatial data, optimizing financial investment and environmental outcomes.
Contact	Weekly lecture (one hour) and workshop (two hours). For the last five weeks there will also be a seminar session with teaching assistants.
Assessment	The assessment for the module will be composed of two tasks: a. A ten minute group presentation. Groups will select a single city and detail how Earth observation data could be applied to or improve their local, national or metropolitan development plans in achieving global development goals (e.g. New Urban Agenda, Sustainable Development Goals or the Sendai Framework for disaster risk

	reduction). The presentation will require no analysis to be undertaken. b. A completed online portfolio workbook for the module. The portfolio workbook will be marked using the online version, but also checked using Turnitin through a pdf copy. Each week students will be expected to add a chapter to their portfolio workbook and complete the following tasks: 1. Undertake short discussion questions with reference to literature. 2. Provide a concise summary of the concepts taught each week with reference to literature and any possible methodological advancements. 3. Take notes of required (and any additional independent) reading, summarizing each piece and providing a narrative through the work. This could include both flow diagrams and written work or any other suitable alterative.
Module convenor	Dr Andrew MacLachlan
Lecturers	-

3.4 Student handbook

In previous years students and staff were frustrated by the range of links required for various actions (e.g. extension forms, extension criteria and module descriptions). In addition to the requirement of teaching and learning online, during the summer of 2019 the departmental graduate tutor and the programme leads converted the student handbook to a Moodle site. Guest access has been granted to our main CASA Moodle site by the SCUA programme lead. To access the site go to: https://moodle.ucl.ac.uk/login/index.php and select 'login as a guest'. Search for the site called 'CASA General Teaching Information'. Scroll to the bottom of the page and enter the password CASARGS2021.

In navigating the site there are two levels of headers within the horizontal bars. When the Welcome tab is selected the tabs beneath it provide general information regarding progression through the department (e.g. welcomes from the director and graduate tutor and referencing and plagiarism). When Smart Cities and Urban Analytics + RTPI is selected in the first level horizontal bar the second level horizontal bar updates to programme specific information. Within the timetable tab students are able to directly access the Moodle pages for their modules, however this information is beyond the handbook and those pages are not setup for guest access.

There is a lot information within our Moodle handbook site, but the following list details some of the main benefits:

- Students have access to all forms and criteria they may require throughout their degree (e.g. extension applications and relevant academic contacts).
- Students can visualise their timetables and easily find module descriptions in one place.
- There is a single site containing all of the introduction week material (e.g. welcome talks and the how to succeed in your degree presentation) and extra circular material such as careers events and social quizzes.
- Academics can update all material during term time (e.g. careers events) which was not possible with a static handbook.

3.5 Additional evidence

Within the submitted supplementary folder and this section, the following additional supporting evidence is provided that has been referenced throughout the application:

Within the supplementary folder

- Dissertation documents including: the old and new mark scheme, Westminster council dissertation project brief and the student handbook.
- Annotated bibliographies from the Urban Systems Theory and Smart Cities: Context, Policy and Governance modules
- The paper submitted from the Geographic Information Systems and Science module: MacLachlan, A and Dennett, D. 2020. ‘An Applied Geographic Information Systems and Science Course in R’, The Journal of Open Source Education.
- External examiner reports from the last three years.
- Survey reports including: the 2017 Internal Quality Review recommendations, the 2019 -2020 Annual Student Experience Review, the 2020 Postgraduate Taught Survey and 2020 Term 1 modules Opinio surveys.

Detailed below

- Staff recognition in UCL teaching awards.
- Staff development information.
- An assessment matrix, mapping modules against assessment type.

3.5.1 Staff academic recognition

Staff members nominated in the UCL student choice teaching awards are listed on the UCL Roll of Honour. Staff can also nominate fellow colleagues for the Provost's Education Awards.

Table 5: SCUA staff nominated for student choice awards and listed on the UCL Roll of Honour along with staff nominated for the Provost's Education Awards (by fellow academic staff).

Staff member	Year	Award
Dr Andrew MacLachlan	2019/2020	UCL Roll of Honour for inspiring teaching delivery (nomination)
Dr Huanfa Chen	2019/2020	UCL Roll of Honour for amazing student support (nomination)
Dr Huanfa Chen	2019/2020	UCL Roll of Honour for diverse and inclusive education (nomination)
Dr Sarah Wise	2019/2020	UCL Roll of Honour for exceptional student feedback (nomination)
Dr Sarah Wise	2019/2020	UCL Roll of Honour for inspiring teaching delivery (nomination)
Dr Thomas Oléron Evans	2019/2020	Provost's Teaching Award nomination (nominated by his peers)
Mr Steven Gray	2019/2020	UCL Roll of Honour for inspiring teaching delivery (nomination)
Mr Steven Gray	2019/2020	UCL Roll of Honour for active student partnership (nomination)
Mr Steven Gray	2019/2020	UCL Roll of Honour for excellent personal tutoring (nomination)
Mr Steven Gray	2017/2018	UCL Roll of Honour for outstanding teaching (nomination)
Dr Thomas Oléron Evans	2017/2018	UCL Roll of Honour for outstanding teaching (nomination)
Dr Elsa Arcaute	2015/2016	UCL Roll of Honour for outstanding teaching (nomination)
Dr Adam Dennett	2015/2016	Outstanding teaching (winner)
Dr Hannah Fry	2013/2014	Provost's Teaching Award (winner)

3.5.2 Staff teaching and learning professional development

Table 6: SCUA staff accreditation to the higher education academy or equivalent qualification.

Staff member	Year	Award
Dr Andrew MacLachlan	2020	Fellow of the Higher Education Academy
Dr Sarah Wise	2020	Fellow of the Higher Education Academy
Dr Jens Kandt	2018	Fellow of the Higher Education Academy
Dr Jon Reades	2015	Fellow of the Higher Education Academy
Mr Steven Gray	2014	Fellow of the Higher Education Academy
Dr Thomas Oléron-Evans	2010	Postgraduate Certificate in Education
Dr Adam Dennett	2002	Postgraduate Certificate in Education

3.5.3 Assessment matrix

Table 7: SCUA assessment matrix with word count and weighting details provided.

	Formative task	**Specific short task**	**Data or theory question responses**	**Independent and creative report**	**Group presentation**	**Group project**	**Thesis**
Term 1							
Urban Systems Theory			2 x 800 word theoretical concept question responses (40% each)	1 x 400 word study outline based on a urban health disparities or compact urban form (20%)			
Geographic Information Systems and Science	short proposal form			1 x 3,000 word geo-spatial report (100%)			
Introduction to Programming		1 x 2 hour timed coding test (15%)	1 x 1,050 word data biography, using provided data (25%)	1 x 2,500 word data-led policy or marketing brief (60%)			
Quantitative Methods			1 x 1,000 word data investigation, using provided data (20%)	1 x 1,750 word research investigation (60%)	1 x 10 minute data and methods group presentation (20%)		
Term 2							
Smart Cities: Context, Policy and Government			2 x 800 word smart city initiative reflections (40% each)	1 x 400 word smart city policy proposal (20%)			
Urban Simulation				1 x 3,000 word, 2 part report			

				evaluating resilience and spatial interaction models (100%)			
Term 2/3							
Spatial Data Capture, Storage and Analysis	1 x 10 minute group project pitch	1 x 500 word individual reflection (no assessment value)			1 x 15 minute group project presentation demonstrating the website (10%)	1x interactive group website conveying data analysis and insight (60%) 1x 5,000 word group report detailing website creation, development and execution (30%)	
Dissertation	short proposal form						1 x 10,000 word thesis (100%)

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