Royal Geographic Society Programme Accreditation

MSc Urban Spatial Science

The Bartlett Centre for Advanced Spatial Analysis

Bartlett Faculty of the Built Environment

University College London

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September 2021

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1 Learning outcome mapping

1.1 Term 1

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 S3, 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 urban data leading to data-informed decisions and policies (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 S1-5, 7 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
Foundations of Spatial Data Science	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of urban data leading to data-informed decisions and policies (A2).	K3 S4-5, 7 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	1a 2a, c 3a-d 4a, c, d-e

			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).	
Quantitative Methods	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of urban data leading to data-informed decisions and policies (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

1.2.1 Smart Cities and Urban Policy Pathway

Table 2: Term 2 Smart Cities and Urban Policy Pathway 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 and reflect upon commonly used concepts, methods and buzzwords in urban analytics and governance, providing confidence in responding to technological transitions and a robust foundation for future employment (A4).	K2-3 S3, 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 urban data leading to data-informed decisions and policies (A2). Explore emerging technological innovations, methodologies and theories in cities across the Globe to tackle fundamental governance and sustainability problems	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	2a-c 3a,c-d 4b

	facing the urbanised World (A3).		skills, techniques, methods and practical applications, concepts and theories applicable to research and advanced scholarship or professional practice (3).	
Remotely Sensing Cities and Environments	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of urban data leading to data-informed decisions and policies (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).	K2-3 S1-7 T1-2, 4, 6	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).	1c-d 2b-c 3a-d 4b

1.2.2 Data Visualisation Pathway

Table 3: Term 2 Data Visualisation Pathway alignment summary with programme aims and learning outcomes alongside RGS criteria

Module	**Programme aims**	**Programme learning outcomes**	**Main RGS criteria**	**RBS sub criteria**
Data Science for Spatial Systems	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of urban data leading to data-informed decisions and policies (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).	K2-3 S1, 4, 5 T2-4	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).	3a-d 4e
Digital Visualisation: Group Mini Project	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of urban data	K3 S1-5 T1-4	Originality and sound judgement in the application of knowledge to solve geographical problems, together with an advanced	2a-c 3a-d

	leading to data-informed decisions and policies (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).		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).	

1.2.3 Urban Modelling and Simulation Pathway

Table 4: Term 2 Urban Modelling and Simulation Pathway alignment summary with programme aims and learning outcomes alongside RGS criteria

Module	**Programme aims**	**Programme learning outcomes**	**Main RGS criteria**	**RBS sub criteria**
Urban Simulation	See table 2			
Data Science for Spatial Systems	See table 3			
Agent Based Modelling for Spatial Systems	Equip students with qualitative, quantitative and spatial analytic skills for the interpretation of urban data leading to data-informed decisions and policies (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, 3 S1-4 T2, 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

1.3 Term 2/3

Table 5: 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 urban data leading to data-informed decisions and policies (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 and reflect upon commonly used concepts, methods and buzzwords in urban analytics and 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 S1-7 T2-6	The majority of RGS criteria are demonstrated in the dissertation module, see written explanation for further detail.	Majority

2 Supporting evidence

2.1 Programme summary

Programme title:	MSc Urban Spatial Science
Routes:	• TMSARCSSCU01 – Urban Spatial Science • TMSARCSSCR01 – Urban Spatial Science RTPI route (currently suspended)
Pathways:	Pathways: • Smart Cities and Urban Policy • Data Visualisation • Urban Modelling and Simulation
Cognate programmes:	N/A
Portico programme code:	TMSARCSSCU01
UCAS code:	N/A
HECoS Code(s)[1]:	100199 – Urban and Regional Planning 100666 – Urban Geography 100402 – Mathematical Modelling 100369 – Geographical Information Systems 100392 – Applied Science 100592 – Urban Studies
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
Admissions tutor:	Dr Andrew MacLachlan, Dr Valerio Signorelli, Professor Adam Dennett, Dr Huanfa Chen, Dr Martin De-Jode, Professor Andrew Hudson-Smith
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

2.1.1 Awards

Final qualification:	MSc
Field(s) of study:	Urban Spatial Science
Volume and level of credit required for qualification:	180 credits at level 7
Qualification level:	FHEQ Level 7

2.1.1.1 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	7	60 credits at level 7		Interim/Exit (not an	No

(PG Cert)				advertised outcome)	

2.1.1.2 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					

2.1.2 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

2.1.3 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

2.1.4 Programme description

Summary programme description:	The Urban Spatial Science MSc programme equips students with a multi-disciplinary and critical perspective on approaches to understanding, monitoring and improving global urban resilience and sustainability through the use of data. Taught content explores the theoretical, social and scientific foundations of the modern built environment through a geo-spatial, data-oriented lens. We also cultivate a practical appreciation of the technical and methodological 'state-of-the-art' associated with urban analytics and data-driven decision making, including: mathematical, statistical and simulation modelling, computer programming, spatial analysis and visualisation. Importantly, these practical skills are underpinned by broad theoretical perspectives on demographics, economics, form and function, network interactions and complexity, governance and policy, planning and, crucially, urban science. The programme is composed of three pathway options: (1) Smart Cities and Urban Policy, (2) Modelling and Simulation, and (3) Visualisation. Core concepts applicable to all programme pathways provide a foundation in urban spatial science, with pathways supporting optional thematic

	specialisation. The programme is deliberately cross-disciplinary, drawing on staff with backgrounds in geography, planning, computer science, physics, as well as the arts and humanities. We do not require a specific undergraduate degree, only a 2:1 classification or equivalent, and seek to encourage creative engagement with the ideas of urban spatial science while recognising the wide range of degrees and prior employment that could be developed with an Urban Spatial Science MSc. Core modules do not presume prior knowledge and the practical application of taught materials informs the programme aims and learning outcomes. Through learning what is possible with code, about the benefits of data-informed urban analytics, and (as importantly) about the limitations technology-led solutionism, our graduates are distinguished as being simultaneously technically-capable but critically reflective, able to look past the hype that accompanies the buzz around smart cities, urban data science, and urban science.
Outline programme structure:	Students undertake modules to the value of 180 credits. The programme consists of three compulsory 15 credit modules (45 credits), with 45 credits of pathway specific modules alongside, one 15 credit optional module (within CASA), one 15 credit elective module (within CASA or any other UCL department) or a 30-credit optional module (within CASA) and a 60-credit compulsory dissertation module.
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 spatial science and the wider urban planning and policy fields (see

	the summary programme description and learning outcomes for specific skills). Since its original inception in 2013, 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.

2.1.5 Learning and assessment

Teaching and Learning methods/strategies:	The modules on the programme are delivered through a combination of diverse teaching and learning activities in traditional and 'flipped' formats. Lectures feature widely, as do computer-based practical classes, tutorials alongside both 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. This usually involves meeting in the partner's office (the academic supervisor is typically present as well), but on occasion students may be allocated a workspace. 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 urban data leading to data-informed decisions and policies (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 and reflect upon commonly used concepts, methods and buzzwords in urban analytics and 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 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 critically assess their applicability for urban focused studies (S1). • Explain and implement relevant geo-spatial analytical and visualisation approaches in relation to relevant theory (S2). • Propose smart, data-informed and appropriate solutions for contemporary and future urban challenges (S3). • Undertake spatial analysis and urban science research to produce outputs — including data visualisation — appropriate to the intended audience (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).

	• Draw on taught ‘best-practice’ in industry and academia to write reproducible code and analytical workflows to obtain, wrangle, and analyse data (S7). **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, and analyse data, and appropriately communicate the results based on the intended audience (T3). • Realistically solve problems based on the available data, resources, and expertise (T4). • Write balanced and concise reports that consider available evidence — and its limitations — 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, workbooks, and a final research dissertation.

Subject benchmark statement:	No directly applicable subject benchmark statement

2.1.6 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.

2.1.7 Modules (programme diet)

Details of modules available on the programme (including those which are compulsory):	The degree consists of compulsory modules in term 1 and pathways or recommended modules in terms 2 and 3, alongside a final dissertation in term 3. **Urban Spatial Science MSc** **Urban Spatial Science** Compulsory modules (45 credits + dissertation): • CASA0005 Geographic Information Systems and Science (15 credits) – term 1 • CASA0007 Quantitative Methods (15 credits) – term 1 • CASA0001 Urban Systems Theory (15 credits) – term 1

	• CASA0010 Urban Spatial Science Dissertation (60 credits) – term 3 **Smart Cities and Urban Policy Pathway** Pathway modules include: • CASA0008 Smart Cities: Context, Policy and Government (15 credits) – term 2 • CASA0002 Urban Simulation (15 credits) – term 2 • CASA0023 Remotely Sensing Cities and Environments (15 credits) – term 2 **Data Visualisation Pathway** Pathway modules include: • CASA0006 Data Science for Spatial Systems (15 credits) – term 2 • CASA0003 Digital Visualisation: Group Mini Project (30 credits) – term 2 **Urban Modelling and Simulation Pathway** Pathway modules include: • CASA0006 Data Science for Spatial Systems (15 credits) – term 2 • CASA0011 Agent Based Modelling for Spatial Systems (15 credits) – term 2 • CASA0002 Urban Simulation (15 credits) – term 2 All pathways have 30 credits of additional optional modules. At least one of these should be taken from within the CASA module catalogue - both could be, but students will also have the option to take one 15 credit elective outside their programme of study, departments at UCL with suitable relevant elective modules are listed below. This allowance could be used with a 30 credit CASA module (e.g.

	Data Visulisation: Group Mini Project). In addition to the modules listed above (on other pathways) CASA also offers: • CASA0013 Foundations of Spatial Data Science (formerly Introduction to Programming for Spatial Analysts) (15 credits) – term 1 • CASA0009 Spatial Data Capture, Storage and Analysis (30 credits) – term 2/3 **Elective modules** Departments at UCL with suitable relevant elective modules include: Geography, Science, Technology, Engineering and Public Policy, Civil Environmental & Geomatic Engineering, Information Studies, Computer Science, Bartlett School of Environment, Energy and Resources, Bartlett School of Architecture and the Bartlett School of Planning. **Urban Spatial Science RTPI route (TMSARCSSCR01)** **Compulsory modules** In addition to those on the MSc Urban Spatial Science Programme the following modules are compulsory: • BPLN0042 Urban Design: Place making (15 credits), usually term 1 • BPLN0055 Planning Practice (15 credits), usually term 2 **Optional Modules**

	The RTPI route has 45 credits of optional modules from the selection above. This route is currently suspended until further notice pending re-accreditation from the RTPI.
Details of any modules and/or components which are non-condonable (including rationale):	CASA0010 Urban Spatial Science Dissertation is non condonable as per the Academic Manual, Chapter 4, Section 9.3.4.3 **RTPI route only** It is a condition of the RTPI that no modules are condonable on the RTPI route. The route is currently suspended until further notice pending re-accreditation from the RTPI.

2.1.8 Admissions

UCAS Keywords:	N/A
Entry criteria:	This programme requires: An equivalent of a 2:1 A standard level of English For the MSc Urban Spatial Science RTPI route applicants must hold an accredited RTPI undergraduate degree. Those without an RTPI accredited degree can enrol on the route but their degree will not have RTPI accreditation.
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	September, annually

beginning of term, please also indicate the expected start date):	
Details of any additional costs to students:	N/A

2.2 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 2.3.

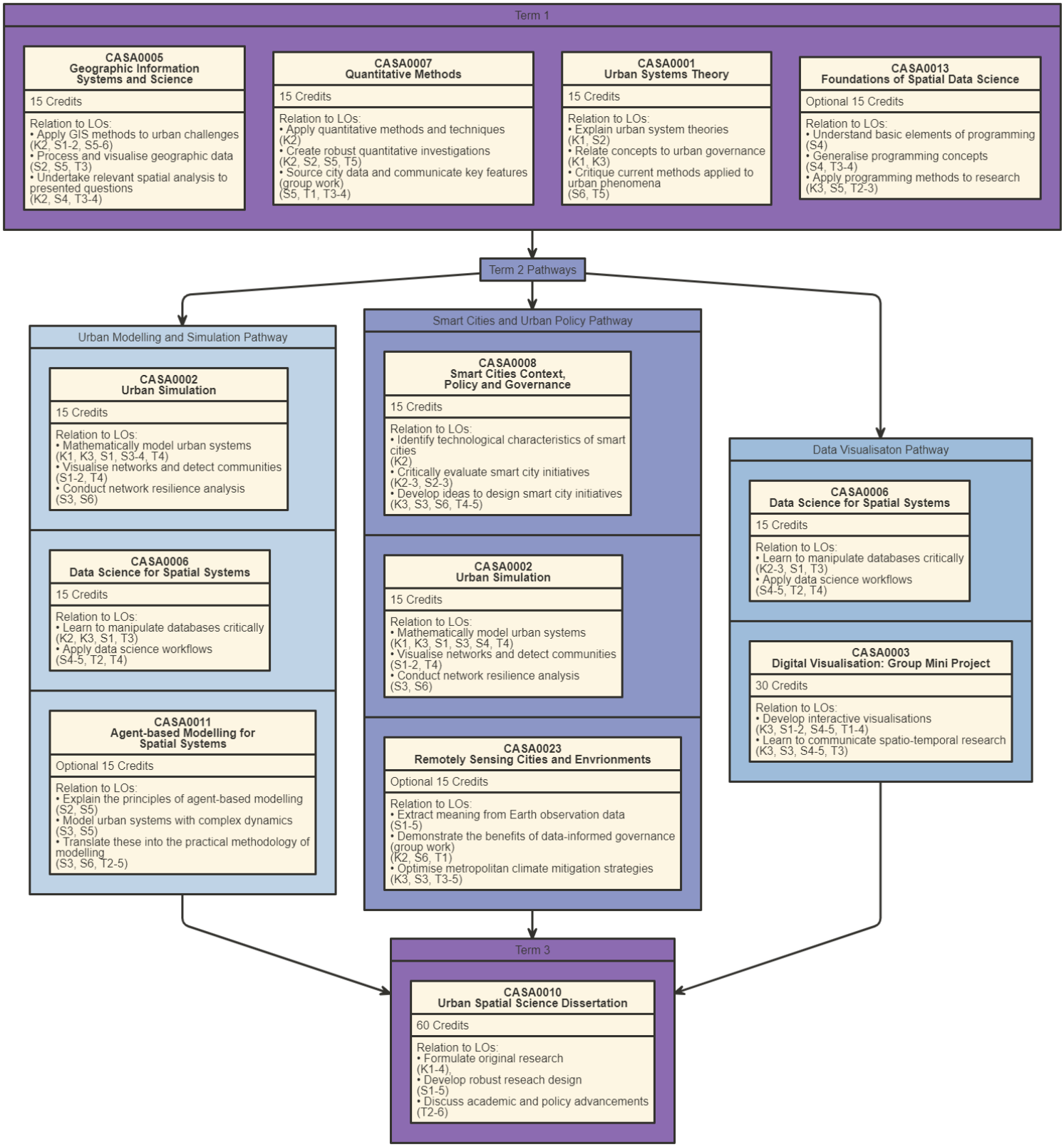

Figure 1: Schematic representation of the MSc Urban Spatial Science structure per academic term. The learning outcomes and codes (e.g. K1, S1, T1) refer to the relationship of the abbreviated module learning outcomes (specified as text) to the programme learning outcomes (specified with codes) within section 2.1.5. This diagram can viewed online along with the code developed to produce it. Students have 30 credits of optional modules (that could include one elective (from the list of external modules in the covering letter)), with Foundations of Spatial Data Science strongly recommended in Term 1. CASA also offers Spatial Data Capture, Storage and Analysis (CASA0009) as a 30 credit optional module

2.3 Module summaries

2.3.1 Term 1 module

All term 1 modules summaries were provided in the original application

2.3.2 Term 2 modules

2.3.2.1 Digital Visualisation (CASA0003)

Module name	Digital Visualisation
Module code	CASA0003
Credits	15
Compulsory	No
Pathway	Data Visualisation
Term	2
Module description	This module teaches students how to create spatial data visualisations from scratch; understand cartographic design principles; and build 2D and 3D interactive data visualisations using web technologies. The module is a key part of CASA's Masters programs and follows on from the programming skills taught in Foundations of Spatial Data Science. There are also important connections with the GIS skills taught in Geographic Information Systems and Science and the data science skills that will be developed in Data Science for Spatial Systems. Digital Visualisation is a research model, and the emphasis is on students developing their projects, with a series of workshops exposing them to new skills and techniques.
Module summary	The module focuses on teaching Digital Visualisation skills as a key method for conducting urban spatio-temporal analysis. The topics

	covered include Html, Interactive mapping, APIs and Spatial Computing.
Learning outcomes	• Learn to create visualizations from scratch; build confidence in understanding and manipulating spatial, attribute and spatio-temporal data. • Link GIS to programming and visualization techniques, particularly using web-based technologies. • Understand cartographic design principles; successfully apply appropriate visualisation methods for different data types and research questions. • Understand the advantages and design challenges of interactive visualisation methods; design relevant levels of user interaction for different applications and audiences. • Develop skills in communicating research outcomes using engaging and concise visualisation methods. Experiment with new research-led visualisation methods. • Provide students with a relevant intellectual toolkit for future research and professional development.
Contact	45-minutes weekly lectures followed by two-hour weekly workshops
Assessment	Organised in 4 parts: 1. Individual Visualisation Submission (20%) 2. Group Project 2.1 Presentation (20%) 2.2. Report (25%) 2.3 Outputs (slides and supporting materials) (35%)
Module convenor	Dr Duncan Smith
Lecturers	Dr Valerio Signorelli

2.3.2.2 Data Science for Spatial Systems (CASA0006)

Module name	Data Science for Spatial Systems
Module code	CASA0006
Credits	15
Compulsory	No
Pathway	Data Visualisation and Urban Modelling and Simulation
Term	2
Module description	The purpose of this module is to provide students with both the technical and critical skills required for the treatment and advanced analysis of spatial datasets. During the first part of the course, 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 advanced data analysis. Methods for the advanced analysis of structured and unstructured data will be explored in some detail, before students move on to learn a comprehensive analysis workflow.
Module summary	The module focuses on teaching real world skills to build computational systems that enable the analysis of spatial data in an insightful way. The topics covered include programming with SQL, data science methods and applications for advanced spatial analysis.
Learning outcomes	• 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 supervised learning (e.g. regression and classification) and unsupervised learning (e.g. clustering and dimensionality reduction). • Understand the basics of analysing unstructured datasets (e.g. image). • Understand basic machine learning workflows
Contact	One-hour weekly lectures and two-hour weekly workshops
Assessment	A 2,000 words Technical Analysis and Visualisation Report plus a reproducible Python Notebook containing the code required to conduct the analysis (100% of the overall module assessment).
Module convenor	Dr Huanfa Chen
Lecturers	Mr Steven Gray

2.3.3 Assessment matrix

Table 6: Urban Spatial Science assessment matrix with word count and weighting details provided. Modules are 15 credits unless otherwise stated.

	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		1 x open book exam (over 1 day) answering from a choice of research questions (100%)					
Foundations of Spatial Data Science		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 and Urban Policy Pathway							

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%)			
Remotely Sensing Cities and Environments				1 x course portfolio workbook. Equivalent of 2000 words, but no limit specified (70%)	1 x 10 minute small group presentation (30%)		
Data Visualisation Pathway							
Data Science for Spatial Systems				1 x 2,000 word technical report with Python Notebook (100%)			
Digital Visualisation: Group Mini Project	1 x group project pitches			1 x individual visualisation submission (20%)	1 x 20 minute group presentation (20%)	1 x group report, 1500 words per person (25%) 1 x module outputs (35%)	
Urban Modelling and Simulation Pathway							
Urban Simulation	See Smart Cities and Urban Policy Pathway						
Data Science for Spatial Systems	See Data Visualisation Pathway						

Agent Based Modelling		1 x agent based modelling research proposal (500 words, 10%)	1 x agent based modelling systematic experimentation (1,000 words, 30%)	1 x development of an based model for the proposal submitted in the first assignment (1,500 words, 60%)			
Term 2/3							
CASA optional module							
Spatial Data Capture, Storage and Analysis (30 credits)	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 (60 credits)	1 x short proposal form						1 x 10,000 word thesis (100%)