Course Specification

A. Course Information				
Final award title(s)	BEng (Hons) Building Services Engineering Apprenticeship (Advanced Entry) (Site Management)			
Intermediate exit award title(s)	N/A			
UCAS Code		**Course Code(s)**	**4947**	
	London South Bank University			
School	☐ ASC ☐ ACI ☒ BEA ☐ BUS ☐ ENG ☐ HSC ☐ LSS			
Division	Civil and Building Services Engineering			
Course Director	Dr Alex Paurine			
Delivery site(s) for course(s)	☒ Southwark ☐ Havering ☐ Other: please specify			
Mode(s) of delivery	☐Full time ☒Part time ☐other please specify			
Length of course/start and finish dates	**Mode**: Part time; **Length years**: 3.5 + EPA; **Start - month**: September; **Finish - month**: July			
Is this course generally suitable for students on a Tier 4 visa?	Please complete the International Office questionnaire No			
Approval dates:	Course(s) validated / Subject to validation	02/08/2018		
	Course specification last updated and signed off	September 2019		
Professional, Statutory & Regulatory Body accreditation	Chartered Institution of Building Services Engineers (CIBSE); Energy Institute (EI)			
Reference points:	Internal	Corporate Strategy 2015-2020 Academic Quality and Enhancement Manual School Strategy LSBU Academic Regulations		
	External	- Engineering Council, Accreditation of Higher Education Programmes (Third Edition 2014); - Joint Board of Moderators Guidelines for Developing Degree Programmes, January 2018 (Version 1 – Revision 2) - Institute for Apprenticeships, Building Services Site Management (Degree) Standard ST0040		

		- CIBSE and Energy Institute for EPA and On-the-Job training programme - Industrial Advisory Panel for programme support QAA Quality Code for Higher Education 2018 Framework for Higher Education Qualifications Subject Benchmark Statements (Dated) PSRB Competitions and Markets Authority SEEC Level Descriptors 2016

B. Course Aims and Features

Distinctive features of course	LSBU has almost 70 years' expertise in running Building Services Engineering courses and it produces around 50% of graduates in the industry. Our BEng (Hons) course is designed to equip apprentices with the technical, management and communication skills needed to be an effective leader of teams and innovator in the design of building services and energy conservation in buildings. It is also partially fulfilling the requirements of the apprenticeship scheme. UK buildings are currently responsible for about 50% of the country's total energy consumption and CO_2 emissions. Energy conservation and sustainability therefore form an increasingly important theme in our courses. This standard caters those students holding a HNC in a relevant Built Environment discipline, and wanting to make progression at levels 5 and 6. This is the reason for this course to be set up with advanced entry requirements at level 4. In the second year (Level 5) the modules provide advanced mathematics and scientific principles and in-depth study of the systems used in building services such as air conditioning, refrigeration and electrical services. Project and Business Management are also introduced at this stage of the course. The module of Intergraded Building Design provides the opportunity for the students to practice their knowledge in building services systems, develop skills in understanding and communicating with other professionals in the built environment whenever possible and further develop their skills in the use of commercial software packages. The Project and Business Management module, including some innovation and enterprise topics, introduces the development of a business plan. A number of topics cut across both the business and project management areas such as risk management, budgeting, cash flow and other financial considerations in running a business. In the final year the emphasis is on sustainability. A specialisation option is offered in the final year between mechanical and electrical routes. Two modules are common and these are Energy Control & Management and Passive Building Design. The mechanical option offers the study of advanced heat transfer and dynamic thermal performance of buildings, in depth study of low energy systems and resources. The electrical option focuses on lighting, electrical systems and distribution. The self- managed work done under tutor supervision for the Design Project module culminates the

	knowledge and skills developed during the course. The projects may be research or design based but with the same theme of energy savings and sustainability. As a BEng course, this course encourages apprentices to acquire a deeper understanding of the essential facts, concepts, theories and principles of mechanical and electrical engineering and its underpinning science and mathematics. These core mathematic, scientific and management skills are needed to meet the requirements of Chartered Engineer status.
Course Aims	The general aim of the course is to develop the apprentices' technical, management innovation and communication skills in accordance with the requirements of a Chartered Engineer; the emphasis being on developing skills appropriate to a multidisciplinary, integrated building services, sustainability and energy engineering environment. Chartered engineers will be expected to have good technical and management competence, with critical self-awareness and confidence in applying appropriate design solutions. They will be forward looking and able to make independent decisions based on professional judgment. They will be expected to rise to positions of top management and to lead the industry. They will require good analytical and communication skills, to be able to lead design teams, departments and companies, whilst also being able to work independently. The course is specifically relevant to those wishing to join the Chartered Institution of Building Services Engineers (CIBSE) and/or the Energy Institute (EI). With regard to CIBSE the course provides the management, design and technical skills for those working within the building services industry. The interests of the Energy Institute are represented by the emphasis on energy management, low energy design and an awareness of the relationship of buildings to energy resource and supply issues. The BEng (Hons) Building Services Engineering aims to: 1. Produce graduate apprentices Building Services Engineers satisfying the academic requirements at BEng (Hons) leading towards becoming a Chartered Engineer. 2. Produce graduate apprentices who are trained in the core discipline of Building Services Engineering with emphasis on design and application and the progress of technology through innovation, creativity and change. 3. Develop graduate apprentices' knowledge of mathematics, applied science and engineering methods and also of economics, finance and sustainability in support of the overall aim of the course. 4. Promote the development of research skills, analysis and evaluation of data and the ability to draw conclusions and introduce new concepts and ideas. 5. Promote the development of presentation and communication skills and the ability to argue rationally, draw conclusions and introduce new ideas based on a rigorous and analytical approach to data and systems. 6. Develop graduate apprentices' problem-solving and practical and transferable skills expected of a graduate who will lead multidisciplinary teams with technical, commercial and management staff in industrial and other occupations.

	7. Produce graduate apprentices capable of leading the profession of Energy and Building Services Engineering in the context of modern practice and sustainable development by introducing and promoting advanced techniques and methods and by developing and extending current technologies. 8. Produce engineers who will have the core competencies and enthusiasm to continue lifelong learning and development.
Course Learning Outcomes	The course outcomes have been developed with reference to the JBM guidelines and Engineering Council's Accreditation of Higher Engineering Programmes document, Third Edition (2014). The number and letter in brackets e.g. (SM2i) refer to the Learning Outcomes described in Engineering Council Documentation Appendix C. Also undertaken is the exercise of mapping for compliance of the Apprenticeship Standard based on knowledge, skills and behaviours. Standard Reference Number ST0372. **a)** Apprentices will have **knowledge and understanding** of: A1: Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies. (SM1b) A2: Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems. (SM2b) Ability to apply and integrate knowledge and understanding of other engineering disciplines to support the study of their own engineering discipline. (SM3b) A3: Understanding the need for a high level of professional and ethical conduct in engineering and knowledge of professional codes of conduct. (EL1b) A4: Knowledge and understanding of the commercial, economic and social context of engineering processes. (EL2b) A5: Knowledge of management techniques that may be used to achieve engineering objectives. (EL3b) A6: Understanding of the requirement for engineering activities to promote sustainable development. (EL4b) A7: Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues. (EL5b) A8: Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and risk assessment and risk management techniques. (EL6b) **b)** Students will develop their **intellectual skills** such that they are able to: B1: Understanding of engineering principles and the ability to apply them to analyse key engineering processes. (EA1b)

	B2: Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques. (EA2b) B3 Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action. (EA3b) B4: Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems. (EA4b) B5: Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics. (D1b) B6: Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards. (D2b) B7: Work with information that may be incomplete or uncertain and quantify the effect of this on the design. (D3b) B8: Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal. (D4b/G1b) B9: Plan and manage the design process, including cost drivers, and evaluate outcomes. (D5b) B10: Communicate their work to technical and non-technical audiences. (D6b) **c)** Students will acquire and develop **practical skills** such that they are able to: C1: Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.). (P1b) C2: Knowledge of characteristics of particular materials, equipment, processes or products. (P2b) C3: Ability to apply relevant practical and laboratory skills. (P3b) C4: Understanding the use of technical literature and other information sources. (P4b) C5: Knowledge of relevant legal and contractual issues. Understanding of appropriate codes of practice and industry standards (P5b and P6b) C6: Awareness of quality issues and their application to continuous improvement. (P7b) C7: Ability to work with technical uncertainty. Understanding of, and the ability to work in, different roles within an engineering team. (P8b and P9b). **d)** Students will acquire and develop **transferable skills** such that they are able to: D1: Apply their skills in problem-solving, communication, information retrieval, working with others and the effective use of general IT facilities. (G1b) D2: Plan self-learning and improve performance, as the foundation for lifelong learning/CPD. (G2b) D3: Plan and carry out a personal programme of work, adjusting where appropriate. (G3b) D4: Exercise initiative and personal responsibility, which may be as a team member or leader. (G4b)

	Apprenticeship Standards **Knowledge Apprenticeship Standards** **K1** The mathematical, scientific and engineering principles, methods and modelling that underpin the design of complex building services systems including the quantitative methods used to understand the performance of systems and components and current and emerging technologies. Examples include: comfort criteria, heat transfer calculations, building management systems, fluid dynamics theory for ventilation and water flow, electrical power theory, lighting engineering theory. Using psychrometric charts to determine cooling and humidification loads. Using fan/pump characteristics to determine operating capability **K2** The digital solutions used to model, design, analyse and evaluate building services systems. Examples include: Using building information modelling to design heating, ventilation and air-conditioning systems, and integrate system components with architectural and structural elements. Using computer programs for heating load assessments. Using dynamic thermal modelling programs to calculate carbon emissions and demonstrate compliance with Building Regulations Part L criteria. Using spreadsheet techniques for calculating and summating electric power loads **K3** The research techniques used to improve the performance of building services systems and components with particular reference to sustainability and reduced carbon emissions and including the use of market intelligence and evidence from best practice. Examples include: Using post-occupancy evaluation outcomes indicating the specific occupancy patterns, space usage and behavioural characteristics and their impacts on energy consumption and carbon emissions, so that future designs can be improved **K4** The quality standards, codes of practice, legal and regulatory frameworks such as building regulations and construction and design management regulations that govern the design of building services systems with particular reference to health, safety and welfare and environmental impact. Examples include: Building Regulations Part L Conservation of Fuel and Power and Part F Ventilation; Electricity at Work Regulations, air quality regulations **K5** The principles and techniques of whole life evaluation in the design of building engineering services systems taking into account critical constraints, including due concern for safety and sustainability. Examples include: Running costs for mechanical and electrical systems, including fuel costs and operation and maintenance costs; carbon

	usage assessments including both operational carbon from energy usage and embodied carbon from materials usage, including **K6** The principles and techniques of effective project management including resources, cost and risk assessment. Examples include: project programmes for the building services design activities; resources planning against project stages and 'deliverables' schedules for producing mechanical and electrical drawings and specifications. Using stage-by-stage cost allocation and expenditure profiles and cumulative schedules of risks **K7** How to manage teams and develop staff to meet changing technical and managerial needs. Examples include: building teams, briefing and providing direction, reviewing and appraising performance in relation to delivery of building services projects. Using change-management techniques to address client/architect changes and impacts on building services design loads, layouts and plant spaces **K8** How to communicate effectively through reports, drawings, specifications, presentations and discussions with both technical and non-technical people. Examples include: Contributions to proposals reports for building services solutions to meet the client brief; concept diagrams for explaining the design principles of complex mechanical and electrical systems in layman's terms; specifications for mechanical and electrical installations **K9** Examples include: Dealing in a fair and honest way in activities such as selection of suppliers/contractors for tender lists for building services contracts; and in reviewing tenders and making recommendations for award of contracts **Skills Apprenticeship Standards** **S1** Use a sound, evidence-based approach to problem solving to develop building services engineering design solutions which maintain and enhance the quality of the environment and community and meet client, financial and safety objectives. Examples included: Use feedback from previous projects, and in-use data from operational buildings, and incorporate lessons learnt into building services designs and management systems with cost-benefit analysis **S2** Identify, review and select techniques, procedures and methods best suited to undertake the design of complex building services systems and components. Examples included: comparison and selection of methods for equipment sizing for power systems; assessing the suitability of computational fluid dynamics for understanding thermal and ventilation dynamic characteristics in complex scenarios **S3**

	Promote the continuous improvement of the design of building services systems and components. This includes using market intelligence and best practice and participating in design reviews and evaluation. Examples include: maintaining awareness of technical developments in equipment such as chillers, boilers and generators; and good practice methods for system configurations and control. Participating in design critiques for the building services strategy at the concept design stage **S4** Manage and apply safe systems of work including responsibility for own obligations for health, safety and welfare issues, assessing and controlling risk, working with health, safety and welfare legislation and best practice. Examples include: Undertaking hazard identification and risk assessment for building services systems involving electricity, gas, rotating plant, refrigerants, hot surfaces, testing and commissioning. Planning suitable access and facilities for operation and maintenance of mechanical and electrical equipment **S5** Managing the planning, budgeting and organization of tasks, people and resources through the use of appropriate management systems, working to agreed quality standards, project programme and budget, within legal, contractual and statutory requirements. Examples include: Use employer's quality management system for stage-by-stage project delivery; assessing required person-hours for design, site visits, inspections and witnessing in relation to fees **S6** Manage teams and develop staff to meet changing technical and managerial needs. Examples include: Provide team briefings and guidance on interpretation and application of new energy regulations or employer/institutional design guidance on lighting design **S7** Communicate effectively through reports, drawings, specifications, presentations and discussions with both technical and non-technical people. Examples include: Presenting building services design concepts and proposals to a client using diagrams, data in context and interactive discussions on the intended operational performance and user benefits **S8** Carry out and record the continuing profession development needed to maintain and enhance knowledge and competence as a building services design engineer. Examples include: Learning and evidence records from project activities, such as mechanical/electrical systems design calculations; heating, cooling and power load assessments; lighting calculations; equipment capacities and selection; schematic and layout drawings for mechanical and electrical services; witness reports from commissioning; writing reports; and attendance at seminars, lectures and workshops **Behaviours Apprenticeship Standards**

	B1 Be aware of the needs and concerns of others, especially in relation to diversity and equality **B2** Demonstrate reliability, integrity and respect for confidentiality **B3** Be confident and flexible in dealing with new and changing interpersonal situations **B4** Create, maintain and enhance productive working relationships **B5** Demonstrate a strong commitment to health, safety and welfare **B6** Demonstrate a personal commitment to professional and ethical standards, recognizing one's obligation to society, the profession and the environment. **B7** Take responsibility for personal development, demonstrate commitment to learning and self-improvement and be open to feedback.

C. Teaching and Learning Strategy

knowledge and understanding

Mathematical methods, science relevant to building services engineering, the basic principles of systems, the codes of practice and regulatory framework and the principles of management are taught in specific classes by formal lectures. Laboratory work is used to further reinforce science and system performance. A3, A4 and A5 are introduced in class and subsequently applied in the design application modules. **(Standards K1, K2, K3, K4, K5)**

intellectual skills

B1 through to B4 **(Standards S1 S3)** is supported throughout the curriculum by tutorial sessions, guided private study, laboratory reports and design projects. B5 and B6 **(Standards S2, K5)** are developed at level 5 and Level 6 design project work. The principles of B7 **(Standards S5, K6)** are introduced in the Project Management and Innovation and Enterprise modules at Level 5 and 6 respectively.

practical skills

C1, C2 and C5 **(Standards S4, S2, S1)** are developed with the laboratory work which forms part of about 20% of the modules throughout the curriculum. C3 **(Standards K2)** is taught and applied at all three levels through mainly the design application modules. C4, C6 and C7 **(Standards K6, S5, S6)** are developed by the open-ended design projects at all three levels and particularly with the final Major Project.

transferrable skills

D5 to D9 **(Standards K2, S7, S1, S5, S6, K7)** are reinforced in classes at Level 5 and are developed along with the remaining of D1 through to D9 in tutorial, assignment, laboratory and practical work and in design project work at all levels of the curriculum culminating with the Major Project Level 6. D2 and D5 are supported by lectures. The challenge of promoting D10 **(Standards S8)** is through the enthusiastic dissemination of information through non-lectured methods such as guest speakers, reference to relevant articles in the media, publications by professional bodies and government departments, the internet, and advice to students to join professional institutions and societies.

D. Assessment

knowledge and understanding

Most of the assessment for A1, A2 and A6 **(Standards K1, K6)** will be trough written examinations and classroom tests. Competency in A3, A4, A5, A7 and A8 **(Standards K2, K3, K5, K9, K4)** will be demonstrated through design and project work.

intellectual skills

Written examinations and also laboratory reports and design projects are the main means of assessing B1 to B4 **(Standards S1 S3)**. Design projects provide the means of assessing B5 and B6 **Standards S2, K5)** with the Major Project at Level 6 allowing the student to evidence knowledge and understanding of B7 **(Standards S5, K6)**.

practical skills

All aspects of practical skills are assessed through laboratory work and reports and the design project work. All projects are marked for the critical approach to problem solving and project management with the Major Project giving evidence of the Level 6 attainment. **Standards (S4, S2, S1) Standards (K2) Standards (K6, S5, S6)**

transferrable skills

The experimental work and laboratory reports together with the design project work, throughout the curriculum, form the main means for the assessment of all the transferable skills listed in D1 through to D10. The Major Project provides the evidence of attainment of all transferable skills at Level 6. **(Standards K2, S7, S1, S5, S6, K7)**
(Standards S8)

E. Academic Regulations

The University's Academic Regulations apply for this course. Any course specific protocols will be identified here.

http://www.lsbu.ac.uk/__data/assets/pdf_file/0008/84347/academic-regulations.pdf

The lowest mark in an Assessment that can be compensated is 30%.

F. Entry Requirements

Due to the advanced entry (Level 5) of this course, the entry requirements are as follows:

- BTEC HNC – with three merits including Mathematics at Level 4. For external applicants there will be a diagnostic test of Mathematics under the Course Director discretion.
- A qualification deemed to be the equivalent of the above.

Credit for prior learning (APL)
Applicants may be able to use their learning from work or other life experiences to gain academic credit towards their course of study. Applicants need to demonstrate that their learning is equivalent to formal learning on the course and produce satisfactory evidence. If an applicant has gained a qualification from a professional body or another institution this may be credited towards the University qualification via our transfer credit scheme.

G. Course structure(s)

Course overview

Building Services Engineering at London South Bank University is studied at undergraduate level at HND and BEng (Hons) levels. The HND was deliberately designed using many of the original BEng modules to facilitate 'ladders and bridges' between the courses and opportunities were taken to lecture HND and BEng students together where appropriate. External examiners and accreditation panels have expressed general approval with the operation of mixed classes since first used in 1999.

Professional recognition is an important, if not essential, attribute of the course. This is governed by the Engineering Council AHEP for Incorporated (IEng) and Chartered (CEng) Engineers. Students completing a BEng (Hons) are required to undertake further learning to meet the academic requirements of CEng. This is provided within the Faculty by the MSc Sustainable Energy Systems (recognised by both CIBSE and EI). Alternatively students may undertake an independent personal development route outside of the University. The BEng (Hons) course contains two routes: a Mechanical Services route and Electrical Services route.

All Level 5 modules are common to both routes and contain a broad mixture of mechanical and electrical services together with management and supporting maths and science. 120 credits must be fulfilled at each level. Of the Level 6 modules, two (40 credits) are dedicated to the specialist route with the remainder being a mix of mechanical and electrical and management. 120 credits must be fulfilled at level 6, where 40 of them are fully dedicated to the Major Project. Details of module content may be derived from individual module guides.

BEng (Hons) Building Services Engineering Apprenticeship

	Semester 1 (O-optional, C-compulsory)		Semester 2 (O-optional, C-compulsory)	
	Electrical Services(C)	20		
Year 1			**Thermofluids Engineering(C)**	20
Year 2	**Advanced Engineering Mathematics(C)**	20		
			Refrigeration Air Conditioning and Heat Pumps(C)	20
	Integrated Building Design(C)		**Integrated Building Design(C)**	20
	Project and Business Management(C)		**Project and Business Management(C)**	20
Year 3	**Energy Management and Control(C)**		**Energy Management and Control(C)**	20
	Passive Building Design(C)		**Passive Building Design(C)**	20
	ELECTRICAL OPTION			
	Lighting and Electrical Systems**(O)**	20		
			Electrical Power Systems and Distribution**(O)**	20
	MECHANICAL OPTION			
	Heat and Mass Transfer Applications**(O)**	20		
			Thermal Energy Systems**(O)**	20
Year 3.5	**Design Project**	40		

Placements information

n/a

H. Course Modules

Module Code	Module Title	Level	Credit value	Semester	Assessment EX/CW
BEA-5-460	**Advanced Engineering Mathematics**	5	20	1	70/30
BEA-5-461	**Thermofluids Engineering**	5	20	2	100/0
BEA-5-466	**Electrical Services**	5	20	1	70/30

BEA-5-462	**Refrigeration Air Conditioning and Heat Pumps**	5	20	2	70/30
BEA-5-464	**Intergraded Building Design**	5	20	1-2	50/50
BEA-5-465	**Project and Business Management**	5	20	1-2	50/50
	Common:				
BEA-6-476	**Design Project**	6	40	1	0/100
BEA-6-474	**Passive Building Design**	6	20	1-2	0/100
BEA-6-473	**Energy Management and Control**	6	20	1-2	70/30
BEA_6_476	**Major Project**	6	40	1	0/100
	Electrical option:				
BEA-6-470	Lighting and Electrical Systems	6	20	1	70/30
BEA-6-472	Electrical Power Systems and Distribution	6	20	2	70/30
	Mechanical option:				
BEA-6-471	Heat and Mass Transfer Applications	6	20	1	50/50
BEA-6-475	Thermal Energy Systems	6	20	2	50/50

I. Timetable information

The course will run one day per week for 3.5 years. Timetables will be made available to students when they register.
Students will be notified by email of any changes to the timetable

J. Costs and financial support

N/A

List of Appendices

Appendix A: Curriculum Map
Appendix B: Educational Framework (undergraduate courses)
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Appendix A: Curriculum Map

This map provides a design aid to help course teams identify where course outcomes are being developed, taught and assessed within the course. It also provides a checklist for quality assurance purposes and may be used in validation, accreditation and external examining processes. Making the learning outcomes explicit will also help students to monitor their own learning and development as the course progresses

Modules	A1	A2	A2	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	A3	A4	A5	A6	A7	A8	C1	C2	C3	C4	C5	C5	C6	C7	C7	D1	D2	D3	D4
Maths (L5)		✓																														
Thermo-fluids/Eng Science L(5)	✓			✓	✓																											
Electrical services L(5)				✓	✓	✓																✓			✓							
AC & R L(5)				✓	✓				✓								✓					✓	✓									
Integrated building design L(5)				✓	✓		✓																			✓						
Project and business management L(5)						✓				✓			✓	✓			✓															
Lighting and Electrical L(6)					✓			✓									✓		✓			✓	✓		✓							
Mech H & MT L(6)				✓	✓																✓								✓			✓
Power Sys L(6)						✓				✓								✓				✓			✓		✓					
Energ Syst & Res L(6)		✓								✓	✓				✓												✓					
Energy Management and Controls (L6)															✓						✓					✓	✓					
Passive Building Design L(6)					✓	✓	✓										✓															
Major Project (L6)				✓	✓		✓		✓		✓	✓	✓	✓		✓			✓				✓				✓			✓	✓	✓

		year 1		year 2				Year 3		Elec op		Mech op		
	y3MODULES VS AS	Electrical Services in Buildings	Thermofluids Engineering	Refrigeration, Air Cond. & Heat Pumps	Advanced Engineering Mathematics	Integrated Building Design	Project & Business Management	Energy Management & Controls	Passive Building Design	Lighting & Electrical Systems	Electrical Power Systems & Distribution	Heat & Mass Transfer Applications	Thermal Energy Systems	Major Project
APPRENTICESHIP STANDARDS	**Knowledge**													
	KW1	**TDA**		**TDA**						**TDA**		**TDA**		
	KW2	**TDA**				**DA**			**TDA**		**DA**			
	KW3	**DA**	**DA**	**TDA**		**TDA**	**TD**		**DA**	**TD**		**DA**	**TD**	**DA**
	KW4							**TDA**			**TDA**		**TDA**	
	KW5									**TDA**				
	KW6						**TDA**							**DA**
	KW7					**TDA**	**TDA**							
	KW8	**TDA**	**TDA**	**TDA**		**TDA**	**TDA**	**TDA**	**TDA**	**TDA**	**TDA**	**TDA**	**TDA**	**A**
	KW9						**TDA**							**A**
	Skills													
	SK1					**TDA**		**TDA**						**DA**
	SK2								**TDA**	**TD**		**TD**		**A**
	SK3					**TDA**		**TDA**						
	SK4	**TDA**		**TDA**						**DA**	**DA**			**A**
	SK5						**TDA**							**A**
	SK6					**TDA**								
	SK7	**TDA**	**TDA**	**TDA**		**TDA**	**TDA**		**TDA**	**TDA**	**TDA**	**TDA**	**TDA**	**A**
	SK8													**DA**
	Behaviours													
	BV1													
	BV2													**DA**
	BV3					**TDA**								
	BV4					**TDA**								
	BV5	**TDA**		**TDA**						**TDA**	**TDA**			**A**
	BV6						**TDA**							**A**
	BV7													**A**

The fulfilment of knowledge, skills and behaviours are undertaken via CIBSE on-the-job assessment, OneFile and the EPA

Appendix B: Embedding the Educational Framework for Undergraduate Courses

The Educational Framework at London South Bank University is a set of principles for curriculum design and the wider student experience that articulate our commitment to the highest standards of academic knowledge and understanding applied to the challenges of the wider world.

The Educational Framework reflects our status as University of the Year for Graduate Employment awarded by *The Times and The Sunday Times Good University Guide 2018* and builds on our 125 year history as a civic university committed to fostering social mobility through employability and enterprise, enabling our students to translate academic achievement into career success.

There are four key characteristics of LSBU's distinctive approach to the undergraduate curriculum and student experience:

- Develop students' professional and vocational skills through application in industry-standard facilities
- Develop our students' graduate attributes, self-awareness and behaviours aligned to our EPIIC values
- Integrate opportunities for students to develop their confidence, skills and networks into the curriculum
- Foster close relationships with employers, industry, and Professional, Statutory and Regulatory Bodies that underpin our provision (including the opportunity for placements, internships and professional opportunities)

The dimensions of the Educational Framework for curriculum design are:

- **informed by employer and industry** needs as well as professional, statutory and regulatory body requirements
- **embedded learning development** for all students to scaffold their learning through the curriculum taking into account the specific writing and thinking requirements of the discipline/profession
- **high impact pedagogies** that enable the development of student professional and vocational learning through application in industry-standard or authentic workplace contexts
- **inclusive teaching, learning and assessment** that enables all students to access and engage the course
- **assessment *for* learning** that provides timely and formative feedback

All courses should be designed to support these five dimensions of the Educational Framework. Successful embedding of the Educational Framework requires a systematic approach to course design and delivery that conceptualises the student experience of the curriculum as a whole rather than at modular level and promotes the progressive development of understanding over the entire course. It also builds on a well-established evidence base across the sector for the pedagogic and assessment experiences that contribute to high quality learning.

This appendix to the course specification document enables course teams to evidence how their courses meet minimum expectations, at what level where appropriate, as the basis for embedding the Educational Framework in all undergraduate provision at LSBU.

Dimension of the Educational Framework	Minimum expectations and rationale	How this is achieved in the course
Curricula informed by employer and industry need	Outcomes focus and professional/employer links All LSBU courses will evidence the involvement of external stakeholders in the curriculum design process as well as plan for the participation of employers and/or alumni through guest lectures or Q&A sessions, employer panels, employer-generated case studies or other input of expertise into the delivery of the course provide students with access to current workplace examples and role models. Students should have access to employers and/or alumni in at least one module at level 4.	The curriculum design is informed by CIBSE and EI and the Industrial Advisory Panel at LSBU. Teaching staff on the course are LSBU staff. All apprentices will be working in the Construction Industry and should thus be supported through their studies by their employer. It is recommended that every student has a mentor to support the on job assessment together with CIBSE and EI.
Embedded learning development	Support for transition and academic preparedness At least two modules at level 4 should include embedded learning development in the curriculum to support student understanding of, and familiarity with, disciplinary ways of thinking and practising (e.g. analytical thinking, academic writing, critical reading, reflection). Where possible, learning development will be normally integrated into content modules rather than as standalone modules. Other level 4 modules should reference and reinforce the learning development to aid in the transfer of learning.	These expectations are achieved in the Construction Practice B Module in which academic writing is introduced and in Introduction to Building Services System, which can be seen as an introduction to analytical thinking.
High impact pedagogies	Group-based learning experiences The capacity to work effectively in teams enhances learning through working with peers and develops student outcomes, including communication, networking and respect for diversity of perspectives relevant to **professionalism** and **inclusivity**. At least one module at level 4 should include an opportunity for group working. Group-based learning can also be linked to assessment at level 4 if	There is a Group Project in Construction Practice B. Due to the nature of the scheme, group-based learning is also encouraged in topics such as Mathematics. All modules at all level concerning labs and projects are positively impacting on the experience

	appropriate. Consideration should be given to how students are allocated to groups to foster experience of diverse perspectives and values.	
Inclusive teaching, learning and assessment	<u>Accessible materials, resources and activities</u> All course materials and resources, including course guides, PowerPoint presentations, handouts and Moodle should be provided in an accessible format. For example, font type and size, layout and colour as well as captioning or transcripts for audio-visual materials. Consideration should also be given to accessibility and the availability of alternative formats for reading lists.	Students work in diverse groups in labs and project. Inclusion is guaranteed with the mix of different cohorts during the lectures
Assessment *for* learning	<u>Assessment and feedback to support attainment, progression and retention</u> Assessment is recognised as a critical point for at risk students as well as integral to the learning of all students. Formative feedback is essential during transition into university. All first semester modules at level 4 should include a formative or low-stakes summative assessment (e.g. low weighted in final outcome for the module) to provide an early opportunity for students to check progress and receive prompt and useable feedback that can feed-forward into future learning and assessment. Assessment and feedback communicates high expectations and develops a commitment to **excellence**.	Short in class formative tests are used to check the progress of the students.
High impact pedagogies	<u>Research and enquiry experiences</u> Opportunities for students to undertake small-scale independent enquiry enable students to understand how knowledge is generated and tested in the discipline as well as prepare them to engage in enquiry as a highly sought after outcome of university study. In preparation for an undergraduate dissertation at level 6, courses should provide opportunities for students to develop research skills at level 4 and 5 and should engage with open-ended problems with appropriate support. Research opportunities should	At all levels there are opportunities for the learners to get ready to undertake their individual research project at the end of the degree.

	build student autonomy and are likely to encourage **creativity** and problem-solving. Dissemination of student research outcomes, for example via posters, presentations and reports with peer review, should also be considered.	
Curricula informed by employer and industry need / Assessment *for* learning	<u>Authentic learning and assessment tasks</u> Live briefs, projects or equivalent authentic workplace learning experiences and/or assessments enable students, for example, to engage with external clients, develop their understanding through situated and experiential learning in real or simulated workplace contexts and deliver outputs to an agreed specification and deadline. Engagement with live briefs creates the opportunity for the development of student outcomes including **excellence**, **professionalism**, **integrity** and **creativity**. A live brief is likely to develop research and enquiry skills and can be linked to assessment if appropriate.	The major project introduces the students to working on a live brief as well as several laboratory assignments.
Inclusive teaching, learning and assessment	<u>Course content and teaching methods acknowledge the diversity of the student cohort</u> An inclusive curriculum incorporates images, examples, case studies and other resources from a broad range of cultural and social views reflecting diversity of the student cohort in terms of, for example, gender, ethnicity, sexuality, religious belief, socio-economic background etc. This commitment to **inclusivity** enables students to recognise themselves and their experiences in the curriculum as well as foster understanding of other viewpoints and identities.	This diversity is guaranteed with a successful mmix of full-time, part-time and apprenticeship students where the lecturers encourage the learners to share their knowledge.
Curricula informed by employer and industry need	<u>Work-based learning</u> Opportunities for learning that is relevant to future employment or undertaken in a workplace setting are fundamental to developing student applied knowledge as well as developing work-relevant student outcomes such as networking, **professionalism** and **integrity**. Work-based learning can take the form of work experience, internships or placements as	As noted above students on the course are part-time and working in the construction industry where they will have many opportunities to network and undertake work based learning. LSBU tracks and monitors on job progression via OneFile

	well as, for example, case studies, simulations and role-play in industry-standards settings as relevant to the course. Work-based learning can be linked to assessment if appropriate.	
Embedded learning development	<u>Writing in the disciplines: Alternative formats</u> The development of student awareness, understanding and mastery of the specific thinking and communication practices in the discipline is fundamental to applied subject knowledge. This involves explicitly defining the features of disciplinary thinking and practices, finding opportunities to scaffold student attempts to adopt these ways of thinking and practising and providing opportunities to receive formative feedback on this. A writing in the disciplines approach recognises that writing is not a discrete representation of knowledge but integral to the process of knowing and understanding in the discipline. It is expected that assessment utilises formats that are recognisable and applicable to those working in the profession. For example, project report, presentation, poster, lab or field report, journal or professional article, position paper, case report, handbook, exhibition guide.	Student writing skills are taught and assessed at all levels. These skills are needed to produce the lab reports, field trip reports and group project report that form part of the modules assessments.
High impact pedagogies	<u>Multi-disciplinary, interdisciplinary or interprofessional group-based learning experiences</u> Building on experience of group working at level 4, at level 5 students should be provided with the opportunity to work and manage more complex tasks in groups that work across traditional disciplinary and professional boundaries and reflecting interprofessional work-place settings. Learning in multi- or interdisciplinary groups creates the opportunity for the development of student outcomes including **inclusivity**, communication and networking.	Apprentices are introduced to these expectations at all levels and mainly in the laboratory.
Assessment *for* learning	<u>Variation of assessment</u> An inclusive approach to curriculum recognises diversity and seeks to create	There are a range of assessments on the course including as follows:

	a learning environment that enables equal opportunities for learning for all students and does not give those with a particular prior qualification (e.g. A-level or BTEC) an advantage or disadvantage. An holistic assessment strategy should provide opportunities for all students to be able to demonstrate achievement of learning outcomes in different ways throughout the course. This may be by offering alternate assessment tasks at the same assessment point, for example either a written or oral assessment, or by offering a range of different assessment tasks across the curriculum.	Examinations and in class tests. Laboratory Reports. Individual Presentations. Group Presentations
Curricula informed by employer and industry need	<u>Career management skills</u> Courses should provide support for the development of career management skills that enable student to be familiar with and understand relevant industries or professions, be able to build on work-related learning opportunities, understand the role of self-appraisal and planning for lifelong learning in career development, develop resilience and manage the career building process. This should be designed to inform the development of **excellence** and **professionalism**.	As noted above the course is informed by CIBSE and EI and the Industrial Advisory Panel at LSBU.
Curricula informed by employer and industry need / Assessment *for* learning / High impact pedagogies	<u>Capstone project/dissertation</u> The level 6 project or dissertation is a critical point for the integration and synthesis of knowledge and skills from across the course. It also provides an important transition into employment if the assessment is authentic, industry-facing or client-driven. It is recommended that this is a capstone experience, bringing together all learning across the course and creates the opportunity for the development of student outcomes including **professionalism**, **integrity** and **creativity**.	As per Individual Research Project

Appendix C: Personal Development Planning

Personal Development Planning (PDP) is a structured process by which an individual reflects upon their own learning, performance and/or achievement and identifies ways in which they might improve themselves academically and more broadly. Course teams are asked to indicate where/how in the course/across the modules this process is supported.

Approach to PDP	Level 7
1 Supporting the development and recognition of skills through the personal tutor system.	Full time students are appointed a personal tutor. The Course Director is the personal tutor of all part time students. This is brought to the attention of all students at induction, by a welcoming announcement on the bb and also by reference to personal tutoring in the course guide. Students are sent an email informing them who their personal tutor is and the personal tutor invites them to an introductory meeting. There are open surgeries offered by all staff for two hours a week in each semester.
2 Supporting the development and recognition of skills in academic modules/modules.	All modules are structured so that, in total over the duration of the course, the combination of coursework introduces and develops the technical skills at undergraduate level in the fields of experimentation, hands-on computer modelling, design methodology, critical analysis, data interpretation and verification, and research methodologies. Assessed coursework, in stages, provides the feedback for the consolidation and improvement of these academic skills.
3 Supporting the development and recognition of skills through purpose designed modules/modules.	The main technical skills required for an undergraduate building services engineering course are covered in all the taught core modules over the three years of the course. The application of design and analyses skills runs throughout the course in particular in the modules: Professional Skills, Intergraded Building Design, Passive Building Design and Major Project.
4 Supporting the development and recognition of skills through research projects and dissertations work.	The Project module covers the literature gathering and review, referencing techniques, technical writing, results presentation, and research methodologies. The LSBU Librarian (Engineering Section) demonstrates the in-house facilities available for off-line and on-line searches for papers, journals and articles.

	The Project module is based on an individual work undertaken in the final year of the course. A student meets with the supervisor on a term-time weekly session of about fifteen minutes to discuss and monitor progress.
5 Supporting the development and recognition of career management skills.	Representatives of CIBSE and IE are invited to give a presentation to the students on the services offered by their respective institution and also to brief the students on the benefits of the student membership of the institutions. The LSBU Careers and Employability Centre are invited to give a presentation to the students on the services they provide.
6 Supporting the development and recognition of career management skills through work placements or work experience.	There is a strong link between the subject area and the building services industry. Job vacancies and offers for summer or sandwich placement are often offered by industry. The subject area maintains a moodle site where all the offers are advertised and these are announced to the students. Reference to the moodle site is made in the course guide and also during the induction and at regular intervals during the duration of the course.
7 Supporting the development of skills by recognising that they can be developed through extra curricula activities.	Students are encouraged to join the CIBSE Young Engineers Network (YEN) which organises presentations, site visits and social events
8 Supporting the development of the skills and attitudes as a basis for continuing professional development.	Notices of presentations by the various CIBSE specialist groups and by YEN, are brought to the students' attention.
9 Other approaches to personal development planning.	The use of group coursework and peer contribution assessment helps to develop communication skills, time management skills, team working skills and networking. The use of verbal presentation as a form of assessment in a module develops verbal presentation skills.
10 The means by which self-reflection, evaluation and planned development is supported e.g. electronic or paper-based learning log or diary.	Weekly meetings for the Project between the student and the supervisor. Written and/or verbal feedback on assessed coursework.

Appendix D: Terminology

[Please provide a selection of definitions according to your own course and context to help prospective students who may not be familiar with terms used in higher education. Some examples are listed below]

awarding body	a UK higher education provider (typically a university) with the power to award higher education qualifications such as degrees
bursary	a financial award made to students to support their studies; sometimes used interchangeably with 'scholarship'
collaborative provision	a formal arrangement between a degree-awarding body and a partner organisation, allowing for the latter to provide higher education on behalf of the former
compulsory module	a module that students are required to take
contact hours	the time allocated to direct contact between a student and a member of staff through, for example, timetabled lectures, seminars and tutorials
coursework	student work that contributes towards the final result but is not assessed by written examination
current students	students enrolled on a course who have not yet completed their studies or been awarded their qualification
delivery organisation	an organisation that delivers learning opportunities on behalf of a degree-awarding body
distance-learning course	a course of study that does not involve face-to-face contact between students and tutors
extracurricular	activities undertaken by students outside their studies
feedback (on assessment)	advice to students following their completion of a piece of assessed or examined work
formative assessment	a type of assessment designed to help students learn more effectively, to progress in their studies and to prepare for summative assessment; formative assessment does not contribute to the final mark, grade or class of degree awarded to students

higher education provider	organisations that deliver higher education
independent learning	learning that occurs outside the classroom that might include preparation for scheduled sessions, follow-up work, wider reading or practice, completion of assessment tasks, or revision
intensity of study	the time taken to complete a part-time course compared to the equivalent full-time version: for example, half-time study would equate to 0.5 intensity of study
lecture	a presentation or talk on a particular topic; in general lectures involve larger groups of students than seminars and tutorials
learning zone	a flexible student space that supports independent and social earning
material information	information students need to make an informed decision, such as about what and where to study
mode of study	different ways of studying, such as full-time, part-time, e-learning or work-based learning
modular course	a course delivered using modules
module	a self-contained, formally structured unit of study, with a coherent and explicit set of learning outcomes and assessment criteria; some providers use the word 'course' or 'course unit' to refer to individual modules
national teaching fellowship	a national award for individuals who have made an outstanding impact on student learning and the teaching profession
navigability (of websites)	the ease with which users can obtain the information they require from a website
optional module	a module or course unit that students choose to take
performance (examinations)	a type of examination used in performance-based subjects such as drama and music
professional body	an organisation that oversees the activities of a particular profession and represents the interests of its members
prospective student	those applying or considering applying for any programme, at any level and employing any mode of study, with a higher education provider

regulated course	a course that is regulated by a regulatory body
regulatory body	an organisation recognised by government as being responsible for the regulation or approval of a particular range of issues and activities
scholarship	a type of bursary that recognises academic achievement and potential, and which is sometimes used interchangeably with 'bursary'
semester	either of the parts of an academic year that is divided into two for purposes of teaching and assessment (in contrast to division into terms)
seminar	seminars generally involve smaller numbers than lectures and enable students to engage in discussion of a particular topic and/or to explore it in more detail than might be covered in a lecture
summative assessment	formal assessment of students' work, contributing to the final result
term	any of the parts of an academic year that is divided into three or more for purposes of teaching and assessment (in contrast to division into semesters)
total study time	the total time required to study a module, unit or course, including all class contact, independent learning, revision and assessment
tutorial	one-to-one or small group supervision, feedback or detailed discussion on a particular topic or project
work/study placement	a planned period of experience outside the institution (for example, in a workplace or at another higher education institution) to help students develop particular skills, knowledge or understanding as part of their course
workload	see 'total study time'
written examination	a question or set of questions relating to a particular area of study to which candidates write answers usually (but not always) under timed conditions

Appendix E: Team Staff

- Alex Paurine BEng/MEng PhD CEng MIMEchE MInstR MCIBSE FHEA, is the course director of BEng (Hons) Building Services Engineering. He teaches Engineering Mathematics and is an active researcher on fire safety and sustainable energy systems. Alex worked as energy manager for Houses of Parliament and as a mechanical design engineer for a number of consulting companies, and keeps up-to-date links within the industry.
- Gordon Lowry BA PhD CEng FEI MIET SFHEA, is the course director of MSc programmes. He teaches electrical, power and control systems disciplines; he is an active researcher on electrical building services engineering, daylight modelling and the utilisation of building management systems in the analysis of building energy performance. He is a panel member of the Energy Institute.
- Rusdy Hartungi BSc PhD MCIHT AMBCA PR2 SFHEA, is the course director of HND Building Services Engineering. He teaches electrical and power disciplines as well as project business management. Rusdy's research interests are mainly in the area of power quality and energy in building. Prior to becoming an academic, Rusdy spent several years in the building services industry working for a multinational company as an engineer.
- Kika Yiakoumetti BSc MSc CENg MCIBSE SFHEA teaches thermal comfort, HVAC systems and building thermal performance. Her research is focused on solar energy and she is the link of the Industry Advisory Panel.
- Esmail Sauber BEng MSc PhD, teaches subjects in building services engineering area including mathematics and passive building design. His research activities span around building performance modelling, natural ventilation design and control and CFD simulation in the built environment.
- Navpreet Chohan BTEC BEng MSc teaches Construction Practice B with a sound knowledge of construction software, namely REVIT and BIM.
- Metkel Yebiyo BEng MSc PhD MCIBSE MIoR teaches refrigeration air conditioning and heat pumps engineering, being these disciplines the core of his research.
- Haydar Aygun, Stephen Dance and Luis Gomez de Agustina conform the Acoustics Group with the largest intake of acoustics students in the country. They focus on environmental and architectural acoustics teaching disciplines on internal environment and comfort.
- Aaron Gilich BEng MSc PhD MIoE CEng FHEA, teaches Energy Resource and Use Analysis and Environmental Management. His research focuses on the UK energy trilemma of delivering a low cost, low carbon, secure energy system, with two main projects, The Home Energy 4 Tomorrow (HE4T) and The Balanced Energy Network (BEN.
- Andy Ford BSc BEng CEng FCIBSE PPCIBSE is director of research and enterprise for the school. Andy is passionate about low energy design and innovation. Having run his own successful Consulting Engineering practice for many years he is now focused on the next generation. He worked as a consulting engineer in building physics
- Issa Chaer BEng PhD FInstR SFHEA, teaches Design applications, integrated building design and thermal energy systems. Issa has a research portfolio spanning over 15 years with evidence of significant contribution to the advancement of engineering knowledge at national and international levels
- Joy Zhihui Ye BEng MSc PhD MEI FHEA, teaches thermofluids engineering, thermal energy systems and passive building design. Her broad research interests are in energy, the indoor environment and the operational performance of buildings. She worked in heating networks for the private sector.
- Carlos Gonzalo, DET, BEng, MSc, AFHEA, Apprenticeship Academic Lead of the School of Built Environment Architecture. Carlos has significant experience in both Further Education and Higher Education Apprenticeship Programmes. His MSc in Multidisciplinary Engineering makes him fit for purpose to work with both divisions of Building Services and Civil Engineering for which he teaches and leads modules such as Mathematics, Sustainable Construction and Renewable Energy Technologies. He is an active researcher currently focused on a novel technique for fire safety in cladding panels. He also has industry experience

in his country (Spain) where he used to give approval for Built Environment and Industry Installations on behalf of the Council of his city.
Carlos leads the development of the academic part of the programmes and he allocates personal tutors for the apprentices of Building Services Engineering. The tutors from the teaching team are made up of experienced academics who will teach, support and guide apprentices on programme.