Course Specification

A. Course Information			
Final award title(s)	FdEng Rail and Rail Systems Engineering (Signalling and Control)		
Intermediate exit award title(s)	Cert HE in Engineering		
UCAS Code		**Course Code(s)**	5642
	London South Bank University		
School	☐ ASC ☐ ACI ☐ BEA ☐ BUS ☒ ENG ☐ HSC ☐ LSS		
Division			
Course Director	Manoj Ponugubati		
Delivery site(s) for course(s)	☒ Southwark ☐ Havering ☐ Other: please specify		
Mode(s) of delivery	☐Full time ☐Part time ☒other please specify-**BLOCK RELEASE**		
Length of course/start and finish dates			

Mode	Length years	Start - month	Finish - month
BLOCK RELEASE	3 Years + EPA		

Is this course generally suitable for students on a Tier 4 visa?	Please complete the International Office questionnaire NO Students are advised that the structure/nature of the course is suitable for those on a Tier 4 visa but other factors will be taken into account before a CAS number is allocated.	
Approval dates:	Course(s) Subject to validation	Mar 2020
	Course specification last updated and signed off	Sep 20
Professional, Statutory & Regulatory Body accreditation	The modules offered on this FdEng Rail and Rail Systems Engineering (Signalling and Control) course, to support the Rail and Rail systems engineer apprenticeship standard in the relevant pathway, are a combination of modules drawn from our existing expertise, but optimised for Block release delivery, and a set of modules that are newly developed to be shared across the different pathways to support the core knowledge, skills and some behaviours complemented by specialist modules, specific to the pathway, that are newly developed, to support the specialist knowledge and skills aspects as outlined in the standard. These courses will be put forward for accreditation, to the relevant professional body, in time for the graduation of the first cohort. This FdEng course is aimed to **fully meet** the	

	academic requirements for registration as an **Engineering Technician** and partially meet the academic requirements for registration as **Incorporated Engineer.**	
Reference points:	Internal	Corporate Strategy 2020-25 Academic Quality and Enhancement Manual School Strategy LSBU Academic Regulations
	External	Competitions and Markets Authority Guidance SEEC Level Descriptors 2016 QAA -Subject benchmark statement Engineering, 2015 Framework for Higher Education Qualifications (QAA, 2015) THE ACCREDITATION OF HIGHER EDUCATION PROGRAMMES - UK Standard for Professional Engineering Competence (AHEP3 2014)
B. Course Aims and Features		
Distinctive features of course	The FdEng in Rail and Rail Systems Engineering is distinctive in that it teaches the underlying principles of the related theory of electrical and electronic engineering coupled with the required software tools and systems engineering approach to enable learners to gain an understanding of complex engineering projects that complements their practising knowledge,. This course focuses especially on the Signalling and Control aspects. As learners progress through the course, they become more familiar with the rail industry relevant aspects related to signalling and control and the L5 analytical modules provide the background required to understand the complex aspects of signalling systems using mathematical modelling techniques to aid with professional practice. The team project at L5 will provide an opportunity to work in multidisciplinary teams to foster an integrated work culture and also bring out the best of everyone while working as a team and sharing responsibility to see through the team idea into a product or service. The course ultimately complements accrued knowledge both in the general electrical/electronic domain, professional practice aspects, knowledge about application and development of relevant standards, coupled with the technical knowledge gained in the L5 modules, to prepare them either towards a graduate course or achieve best practice in their professional career with the added understanding gained of the various sub systems from a design perspective.	
Course Aims	The programme shares with other FdEng programmes, the aim to produce engineers who have demonstrated the following abilities.	

	1. Develop learners technical skills in pursuit of the progression to be Technical Engineers at level 5 who will, after appropriate further learning, eventually expect to register as Incorporated Engineers subject to meeting the requirements of the professional body such as ECUK and The IET. 2. Produce learners trained in the core discipline of Rail and Rail Systems Engineering with an emphasis on key knowledge and necessary practical aspects. 3. Develop students' knowledge of mathematics, electrical, electronic, applied control, computer systems with programming and professional engineering practices supported by essential mathematical and analytical problem solving skills. 4. Develop students' practical and problem solving skills through the integration of a broad range of subject material relevant to the chosen pathway. 5. Enable students to develop an independent and reflective approach to study and enable them to become more self-directed learners. 6. Teach students to communicate clearly, to argue rationally and to draw conclusions based on rigorous approaches to a range of engineering problems. 7. Develop the transferable skills expected of a L5 engineer. For example, diplomates will be expected to work in multi-disciplinary teams with technical, commercial and management staff in industrial and other occupations. 8. Develop professional working ethics and understanding of the academic environment with motivation and attitude to the practice of engineering at IEng (Incorporated) level and generally be able to practice in electrical/electronic engineering and address such issues as health and safety, time management and attentiveness in performing workshop experiments in consistent to the class lecture notes. **<u>Specific to FdEng in Rail and Rail Systems Engineering (Signalling and Control)</u>** The programme aims to produce graduates who have acquired and can use a broad base of active knowledge in the Rail engineering area with particular focus on signalling and Control: • Appropriate mathematical skills and circuit theory, principle of control. • Digital, analogue and particularly hybrid electronic systems that form part of Rail signalling systems. • Present and future trends in Rail signalling and control. • The principles of engineering and its role in the rail signalling. • Professional engineering studies. • The rules and standards, which apply for QA and the cost and legal implications of their designs. In addition to the General and specific course aims, the apprenticeship course also aims to satisfy the requirements of Knowledge, Skills and Behaviours as laid out in the relevant standard. The attainment/fulfilment of the various aspects of the standard are presented in the form of a mapping document appended to this course specification (see Appendix E) which outlines how

	the modules serve to fulfil the various aspects of the apprenticeship standard, including an indication of whether the coverage is full/partial/basic.
Course Learning Outcomes	**<u>Program Specific Learning Outcomes (UKSPEC)</u>** This course is designed to meet the learning outcomes specified by the UK Engineering Council in its requirements for Accreditation of Higher Education Programmes (AHEP3) that fully satisfy the educational requirements for Engineering Technician, EngTech, status and partially satisfy the education requirements for Incorporated Engineer, IEng, status. The course learning outcomes are based upon the six categories of learning outcomes identified by the UK Engineering Council. **1. Knowledge and Understanding** Engineering is underpinned by science and mathematics and other associated disciplines as defined by the relevant professional engineering institutions. Students will need the following knowledge understanding and abilities: **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 historical, current, and future developments and technologies. **A2**: Knowledge and understanding of mathematical principles necessary to underpin their education in their engineering discipline and to enable them to seek to apply mathematical and methods, tools and notations in the analysis and solution of engineering problems. **A3**: Ability to apply knowledge and understanding to support study of their own engineering discipline. **2. Intellectual Skills** Engineering analysis involve the application of engineering concepts and tools to the solution of engineering problems. Students must be able to demonstrate: B1: Ability to monitor, interpret and apply the results of analysis and modelling in order to bring about continuous improvement. B2: Ability to apply quantitative methods in order to understand the performance of systems and components. B3: Ability to use the results of engineering analysis to solve engineering problems and to recommend appropriate action. B4: Ability to apply an integrated or systems approach to engineering problems through know how of the relevant technologies and their application. **3. Practical Skills** This involves the practical application of engineering skills, combining theory and experience, and the use of other relevant knowledge and skills. Students must be able to demonstrate: **C1**: knowledge of contexts in which engineering knowledge can be applied (e.g. operations and management, technology development, etc.).

	C2: knowledge of characteristics of particular materials, equipment, processes, or products. **C3**: Workshop and laboratory skills. **C4**: Ability to use and apply information or translate information from technical literature and other information sources. **C5**: Understanding of appropriate codes of practice and industry standards. **C6**: Awareness of quality issues and their application to continuous improvement. **C7**: Awareness of team roles and the ability to work as a member of an engineering team. **C8**: Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct. **4. Transferable Skills** Design is the creation and development of an economically viable product, process or system to meet a defined need. It involves significant technical and intellectual challenges and can be used to integrate all engineering understanding, knowledge and skills to the solution of real problems. Students and graduates must be able to demonstrate: **D1**: Understand business customer and user needs.. **D2**: identify constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues, intellectual property; code of practice and standards. **D3**: Apply problem-solving skills to establish generic solutions **D4**: Work individually and as part of a team.

C. Teaching and Learning Strategy

General Learning Outcomes (UK-SPEC)

Knowledge and Understanding:

Graduates must be able to demonstrate their knowledge and they must have an appreciation of the wider multidisciplinary engineering context and its underlying principles. They must appreciate the social, environmental, ethical, economic and commercial considerations affecting the exercise of their engineering judgement.

Teaching and learning strategies:

Acquisition of knowledge and understanding is acquired through in the main by modules teaching and developing knowledge and understanding within a multidisciplinary engineering context and those at higher levels involve a degree of commercial awareness through design of systems to specifications.

Assessment

Assessment is through examinations and also practical work and assignments using logbooks and formal reports.

Intellectual Skills:

Graduates must be able to apply appropriate quantitative science and engineering tools to the analysis of problems. They must be able to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs. They must be able to comprehend the broad picture and thus work with an appropriate level of detail.

Teaching and learning strategies:

Acquisition of IS is gained through the specialist level 5 modules. In these modules students are taught the appropriate tools to solve engineering problems. Innovation is covered in the module entitled Team Design Project at level 5 which develops business ideas from innovative research and development activities.

Assessment

Assessment of IS is through presentations and also formal reports at various stages of project work including a feasibility study. Innovation and design skills are assessed by group work as well as a formal report.

Practical skills:

Graduates must possess practical engineering skills acquired through, for example, work carried out in laboratories and workshops; in industry through supervised work experience; in individual and group project work; in design work; and in the development and use of computer software in design, analysis and control. Evidence of group working and of participation in a major project is expected. However, individual professional bodies may require particular approaches to this requirement.

Teaching and learning strategies:

- Acquisition of PS is acquired during the practical laboratory sessions which constitute a part of nearly every module for this course.
- Further development of these skills is acquired in the Level 5 team project.

Assessment

PS is assessed by log books, coursework assignments and also the level 5 team project which include presentation and a viva voce examination.

General transferable skills:

Graduates must have developed transferable skills that will be of value in a wide range of situations. These are exemplified by the Qualifications and Curriculum Authority Higher Level Key Skills and include problem solving, communication, and working with others, as well as the effective use of general IT facilities and information retrieval skills. They also include planning self-learning and improving performance, as the foundation for lifelong learning/CPD.

Teaching and learning strategies:

Acquisition of GTS is achieved through communication of knowledge in formal reports. These constitute a part of the assessment for the majority of modules on the course.

Assessment

GT skills are assessed by formal reports, presentations and viva voce examinations of the L5 team project.

Teaching and Learning overview (Block Release)

The course is made up of several modules (see section G below) and each module is delivered through a combination of lectures, tutorials, practical workshops, computing workshops etc. all of which amounts to directed teaching (class room contact). There is a variance in the make up of the number of hours dedicated to lectures, workshops etc but the total number of study hours attracted by each module is dependent on the module weighting in credits. Typically, a 20-credit module, requires 200 hours of learning which constitutes both directed learning and independent learning. It is envisaged that for modules delivered via block-release delivery, the lectures are pre-recorded and made available via VLE for learners to become familiar therefore a reduce direct contact time will be scheduled during the block week which is catered for mandatory face-to-face contact, workshop, tutorials etc

Independent Learning

The number of hours of independent learning required is dependent on the nature of the module. Generally, the number of hours of independent learning required increases as you progress from your first year (L4) to final year (L5). Typically, in most taught modules, the directed teaching varies depending on the nature of the content and this may significantly vary in some modules such as Mathematics where more support is offered and Project modules where more individual involvement is expected.

Subject-related and generic resources

The core and optional reading lists are supplied at the end of each module guide produced by the module leader. A copy of the module guide will be made available on the Virtual Learning Environment, VLE (Moodle) and the reading lists can also be accessed through LSBU Library website (http://www1.lsbu.ac.uk/library/).

Learning Support

To support students in their learning journey, academic and support staff are available during the normal operating hours of the university via prior appointment. Academic staff also operate surgery sessions where no prior appointments are needed. The university buildings and library are open from 8am to 9pm during term time, while the library operates for an extended period during examinations. Some specialist workshops/computing spaces etc. are not accessible outside the normal operating hours of 9am to 5pm, unless timetabled for use in a module. Teaching sessions for PT students run until 8/9pm and the relevant and required areas are open for access as timetabled.

All students are allocated a Personal Tutor when they begin their study at LSBU and your personal tutor is who you would see about any problems, not just academic ones (most academic problems will probably be dealt with by lecturers or module leaders or Course Directors). Students are advised to establish contact with their personal tutor ASAP, and maintain regular meetings through out their study, more so in the first year on the course. Students are briefed about the tutoring systems during the enrolment and orientation process.

Teaching staff

Most modules are delivered by full-time academic staff from within the parent division where the course resides and often by staff from other areas within the school or university where expertise lies. We aim to have each module delivered by a single member of staff (for both teaching and coursework). Occasionally, PG students or part-time staff may support certain sessions and, in such cases, the relevant tutors are trained and care is taken to ensure the quality of the provision.

VLE

Each course has a course site where relevant information is maintained by the respective course director. This is used to post announcements that reach every student enrolled in the course.

Each module on the course has a Module site and all relevant teaching and learning material such as module guides, lecture notes, teaching slides, tutorial and seminar sheets, workshop exercises, past exam papers etc. are made available by the module leader.

The virtual learning environment (Moodle) can be accessed using your windows login credentials and can be accessed from any internet connected PC inside or outside of the university campus.

D. Assessment

Course work in modules can be either formative or summative and the details are usually made available in the module guide and explained to students by the module leader at the beginning of each semester. The module guide will also provide details as to the weight of these assessment components and associated procedure for them, including submission instructions and deadlines.

Each module has a number of assessment *components*, usually, but not always, two. These can consist of assignments, mini tests, essays, laboratory reports and logbooks and examinations of various kinds. The assessment components for each module are specifically defined and kept up to date in the current Module Guide. Note that a component is not necessarily a single piece of work - several pieces of coursework (often referred to as a portfolio) may constitute a single component of the module assessment.

To pass a module, students must obtain an overall **module mark of no less than 40%** and also a minimum **threshold** mark of **30% in each component.** The weighting of each component for calculating the overall module mark is given in the Module Guide, and the module coordinator (or leader or lecturer in charge) will often cover the details of this at the beginning of the delivery of the module.

Progression means moving on from one year to the next, during the studies. Students need to complete (pass) all modules taken/studied at that level by obtaining the minimum component marks and the minimum module marks. Occasionally, with the discretion of the exam board, students may be allowed to progress with an outstanding module(s) and your course director will explain in detail about these. It is important that you understand how progression works and what the rules are. The rules about progression and what happens when a module is failed are carefully set out (along with all the other University rules) in the Student Handbook, a copy of which is handed to all students during enrolment.

The rules about referrals, repeats and extenuating circumstances are defined by the University's Academic Regulations for Taught Programmes and are described in the Student Handbook and also included in the course guide.

E. Academic Regulations, Compensation and Condonement

The University's Academic Regulations apply for this course can be access via https://www.lsbu.ac.uk/__data/assets/pdf_file/0008/84347/academic-regulations.pdf .

Local protocols based on professional body requirements will be applied for the accredited courses.

The University's assessment and examination procedures apply for this course and can be accessed via https://www.lsbu.ac.uk/__data/assets/pdf_file/0010/84349/assessment-and-examination-procedure.pdf. Award of compensation is in line with these procedures and currently exam boards have a discretion to allow compensation of up to 40 credits at any one level and a total of 60 credits for the entire course. There is no over-riding protocol from IET regarding compensations (currently). No compensation is allowed on the project modules. Additionally, the Engineering council has set a maximum limit of 30 credits where compensation can be allowed on a Bachelor's degree and this will be applied to all students joining the first year of the course from Sep 2022.

Although condonement of modules are allowed as per LSBU assessment and examination procedures, the accrediting body IET has dis-allowed this on all our accredited courses which is

applied as a Local Protocol on our current courses. This course will comply with this local protocol, as we will be seeking accreditation from a joint accreditation board (IET, IMechE and PWI) by the time the first cohort graduates. Also, the Engineering council has ruled that Condonements will not be allowed on any modules delivering AHEP outcomes, which rules out every module on any typical Engineering course.

F. Entry Requirements

Course Entry requirements for BEng (Hons) Rail and Rail Systems Engineering (Signalling and Control)

To be considered for entry to the first year of this course applicants will be required to have the following qualifications:

Part-time students

- L3 Network Rail or equivalent Rail apprenticeship; L4 students will be considered for an advanced entry with benefit of few exemptions to modules already covered and similar in nature and content.
- A Level BBB including Mathematics and/or Physical Sciences (120 UCAS points) **or;**
- BTEC National Diploma DDM, including Level 3 Mathematics and Physical Sciences (128 UCAS points) **or;**
- EAL Technical Extended Diploma in Engineering Technologies, D, including: Further Engineering Mathematics; Electrical and Electronic Engineering Principles; and other options relevant to Electrical and Electronic Engineering **or;**
- Access to HE qualifications with 24 Distinctions and 21 Merits, with at least half the course in Mathematics and Physical Science subjects (122 UCAS points) **or;**
- Equivalent level 3 qualifications worth 120 UCAS points and including Mathematics and Physical Sciences
- Applicants must hold 5 GCSEs A-C including Maths and English or equivalent (reformed GCSEs grade 4 or above) **or;**
- We welcome qualifications from around the world. English language qualifications for international students: IELTS score of 6.0 or Cambridge Proficiency or Advanced Grade C, **and** a Mathematics qualification equivalent to reformed GCSE grade 4 or above, as assessed by UK NARIC, **or;**

Recognition of Prior Learning /Transfer Credit

Applicants may exceptionally be considered for entry to the second year of the course with the following qualifications. Applicants will normally be interviewed and may be required to sit a Mathematics test to ensure their preparedness for direct entry. In addition to the academic suitability, apprentices will also be assessed through a formal interview by the course director to establish that they have adequate work experience to support an advanced entry and that their related work experience can be documented through OneFile towards consideration for their e-portfolio/end point assessment. This will usually be in agreement with the employer so that the apprentice is supported fully.

The final decision to accept will be subject to having no complications with levy funding.

Part-time students

- BTEC Higher National Diploma in Electrical and Electronic Engineering or a closely-related subject **or;**
- DipHE in a directly-relevant subject **or;**
- Transfer of 120 Level 4 credits from a directly-equivalent degree course and with the approval of the director of that course **or;**
- An overseas qualification assessed by UK NARIC as equivalent to at least BTEC HND in a closely-related subject **and** an IELTS score of 6.5 or equivalent.

Recognition of Prior Experiential Learning (RPEL)

RPEL may be taken into account in determining the entry requirements for candidates with relevant work experience, but cannot replace the requirement for formal qualifications in Mathematics.

Application to the course

Part-time (apprenticeship route – Levy Funded): direct to the university, via a dedicated webpage

G. Course structure(s)

Course overview

- The academic year is organised into 4 teaching blocks, each lasting one-week and an exam block which lasts 2-3 days.
- The FdEng course is made up of 240 credits and an EPA after completion of study. The course is made up of several modules, most modules are worth 20 credits.
- The part-time FdEng course is delivered across 3 years, in a block-release mode.

FdEng Rail and Rail Systems Engineering (Signalling and Control) – **Part time**

Yr-1 (L4)	Yr-2 (L4+L5)	Yr-3 (L5)	EPA
Mathematics for Engineering L4	Rail Project and Asset Management L4	Rail Electrical Systems and Operation L5	**14 weeks for the Workplace Project and one hour Vocational Competence Discussion, within a 16-week period starting once the apprentice has met the Gateway requirements.**
Principles of Electrical Engineering L4	Advanced Engineering Mathematics L5	Rail Signalling Interface L5	
Analog and Digital Electronics L4	Rail Systems Engineering L5	Rail Standards & Specifications - L5	
Programming for Engineers L4	Rail Industry Professional Practice L4	Rail Engineering Team Design Project L5	
L4 80 CAT	L4 40 CAT, L5 40 CAT	L5 80 CAT	
L5 Qual (FdEng): 120 L4 credits, 120 L5 credits			

H. Course Modules

Module Level	Module name	Assessment	
		CW%	EX%
4	Mathematics for Engineering	50	50
4	Principles of Electrical Engineering	50	50
4	Analog and Digital Electronics	50	50
4	Programming for Engineers	100	0
4	Rail Project and Asset Management	30	70
4	Rail Industry - Professional Practice	50	50
5	Advanced Engineering Mathematics	50	50
5	Rail Systems Engineering	30	70
5	Rail Electrical Systems & Operation	30	70
5	Rail Signalling Interface	50	50
5	Rail Standards & Specifications	50	50
5	Rail Engineering Team Design Project	100	

I. Timetable information

The block release timetable is such that learners are timetabled for 4 teaching weeks, each week having a contact time of 35 hours which will be shared by the 4 modules timetabled. This face to face contact time is typically to be used for workshop, tutorial and queries as it is envisaged that much of the lecture content will be recorded and made available prior to each block.

The timetables are made available to students at least 2 weeks before commencement of each block. Students are however advised to check their timetables via MyLSBU, where any last-minute changes to rooms/staffing will be reflected appropriately.

J. Costs and financial support

Course related costs

- The course fee is the fee published by the university's fee office. Field trips and placement activities, where organised, may cost extra and are not compulsory to attend but students are advised to utilise the opportunities where possible.

- Cost of books and other learning materials is also not included in the course fee. Learning resources are usually made available through VLE (Moodle) and the library holds copies of books recommended as core reading.

Tuition fees/financial support/accommodation and living costs

- Information on tuition fees/financial support can be found by clicking on the following link - http://www.lsbu.ac.uk/courses/undergraduate/fees-and-funding
- Information on living costs and accommodation can be found by clicking the following link- https://my.lsbu.ac.uk/my/portal/Student-Life-Centre/International-Students/Starting-at-LSBU/#expenses

K. End Point Assessment and Accreditation

End Point Assessment:

End Point Assessment (EPA) is the name given to a series of tests an apprentice must take to prove their ability to do the job they have been training for. These tests take place at the end of an apprenticeship following a period of training and development often referred to as the 'on-programme' period. In some Standard based apprenticeships, the on-programme stage may include mandatory requirements, such as supporting qualifications. These must be achieved prior to applying for the EPA. At this point the employer, after discussion with their apprentice and training provider, 'signs off' their apprentice as ready for EPA. This decision process is known as the 'gateway' to End Point Assessment.

There is no common format for an EPA; they vary between apprenticeships. All EPA's are developed from 'assessment plans', drawn up by the trailblazer group responsible for the apprenticeship standard. Assessment plans set out the main requirements for the final testing and what methods should be used. As the experts for their respective workforces, employers can determine the knowledge, skills and behaviours required for job roles, and they will be guided on how best to test for occupational competence in their particular industry.

Importantly, EPA's are not designed to test every single aspect of a Standard. Instead they are designed to enable an apprentice to demonstrate that overall, they have developed the key knowledge, skills and behaviours needed to be able to do their job effectively.

Apprenticeship courses broadly fall into two categories based on whether the end point assessment is an integrated element to the apprenticeship degree or not. Where it is an integrated element, the apprentice cannot obtain his degree without successfully completing the end point assessment and where the EPA is not integrated, an apprentice can graduate with a degree (academic qualification) irrespective of the outcome of the EPA, however this has an implication on the final 20% of the funding to be received by the training provider.

Only approved End Point Assessment Organisations (EPAO) registered with the Education and Skills Funding Agency can deliver End Point Assessments. They can either be awarding organisations, like FDQ, training providers or employers and should feature on the Register of End Point Assessment Organisations a list maintained by the Education and Skills Funding Agency and is the ONLY register an EPAO needs to be on to provide End Point Assessment services.

Often professional bodies such as the IET, IMechE who accredit courses are also registered as EPAO and for the current course, either IET, IMechE or PWI will be approached for EPA of all apprentices graduating on this course.

The End-point assessment for the 'FdEng Rail and Rail Systems Engineering' is not integrated into the apprenticeship degree.

The e-portfolio system, OneFile, used at LSBU is aimed at supporting the apprentice's journey on the course and progress towards the gateway to culminate in the end point assessment (EPA). The purpose of the EPA is to ultimately assess if the learner has met the standard and its

outcomes. Its purpose is to mimic and provide evidence of occupational competence from the work environment. The learner can plan, design, implement and test some artefact. An independent assessor(s) takes a holistic view of the learner's competencies and judges whether they meet the outcomes of the standard.

Every apprentice will be supported, along with employers commitment, to develop a very structured personal development plan which aligns with the knowledge, skills and behaviours within the apprenticeship standard, they will be expected to evidence these as part of their on-line portfolio development. This personal development plan is reviewed as a tri-party process (once per semester) to ensure the apprentice is progressing adequately to be able to meet the gateway requirements and progress to the end point assessment.

The course director (or a skills assessor) along with the employer (line manager and/or mentor) will monitor progress both at University and in the workplace as well as being an invaluable link between the apprentice, LSBU and their employer. They will also be allocated a personal tutor as part of the normal pastoral care for all students within the Division.

Accreditation: Although most accrediting bodies are registered as EPAO's, they also accredit the course and both the processes are kept separate through dedicated panels/individuals leading these activities. The accreditation activity occurs once in every 3 to 5 years whereas the EPA activity is on-going once students approach the gateway and is an annual process.

Accreditation for the current course will be sought from a joint accreditation board (IET, IMechE and PWI) as the first cohort of apprentices approach their gateway.

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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			Course outcomes																	
	Level	**Title**	**Code**	A1	A2	A3	B1	B2	B3	B4	C1	C2	C3	C4	C5	C6	C7	C8	D1	D2	D3	D4
1	4	Mathematics for Engineering	E??_4_???	**TD**	**TA**	**TD**	**TD**	**TA**	**TA**	**TD**												
2	4	Analog and Digital Electronics	E??_4_???	**TA**	**TA**	**TA**	**TA**	**TD**	**TA**	**TD**		**TA**	**TA**	**TD**			**TA**					
3	4	Principles of Electrical Engineering	E??_4_???	**TA**	**TA**	**TA**	**TD**	**TA**	**TA**		**TD**		**TA**	**TD**						**TA**	**TD**	
4	4	Programming for Engineers	E??_4_???	**TA**	**TA**		**TD**	**TD**			**TA**	**TA**							**TD**	**TD**	**TA**	**DA**
5	4	Rail Industry Professional Practice	E??_4_???	**TA**		**TA**	**TA**			**TA**	**TA**	**TA**				**TA**					**TA**	
6	4	Rail Project and Asset Management	E??_4_???	**TA**	**TA**	**TD**	**TA**	**TA**	**TD**		**TD**	**TD**				**TD**					**TA**	
7	5	Advanced Engineering Mathematics	E??_5_???	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**											**TA**	
8	5	Rail Systems Engineering	E??_5_???	**TA**	**TA**		**TA**	**TA**			**TD**	**TA**							**TD**	**TD**		
9	5	Rail Signalling Interface	E??_5_???	**TA**		**TA**	**TA**			**TA**	**TA**		**TA**			**TA**					**TA**	
10	5	Rail Electrical Systems and Operation	E??_5_???	**TA**		**TD**	**TA**	**TA**	**TA**			**TA**	**TA**	**TD**		**TD**				**TD**	**TA**	
11	5	Rail Standards and Specifications	E??_5_???	**TA**		**TD**	**TA**				**TA**	**TD**		**TD**	**TD**	**TA**					**TA**	
12	5	Rail Engineering Team Design Project	E??_5_???	**TA**	**A**	**TA**	**TD**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**	**TA**

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	<u>Outcomes focus and professional/employer links</u> 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.	Industrial Advisory boards, both at school level and division level, feeds into the curriculum design through its twice annually convened meeting. Representatives from professional bodies, are invited to a short seminar session as part of the module Design and Practice where students are informed about how they can engage with professional bodies and build relations with the local networking bodies to secure learning of state-of-the-art aspects of their discipline of engineering in the work arena and also to have access to facilities and professional networks operating in the local area. Students are encouraged to become student members of the professional body (IET) and the division pays for the membership to provide a sound start to their professional engagement. Alumni and employers are invited as guest speakers on the above module whose valuable inputs contribute to the student's ideas and activity which they later put use when competing on a national level in challenges such as the London Mayoral Challenge, Engineers without Borders etc.

Embedded learning development	<u>Support for transition and academic preparedness</u> 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.	Modules at L4 prepare from the basis for academic preparedness and help them with transition to later years in their course. For e.g., The mathematics module provides the underpinning knowledge to enable them to think analytically. This is then reinforced in this module where mathematical models taught in lectures are now analysed and simulated using MATLAB Simulink models. Digital Logic Design module also extended elementary algebra knowledge to Boolean Algebra. This allows students to dissect the model deeper and gain a better understanding in terms of boundary conditions and constraints within which these analytical models can be validated. Academic writing, in its various forms is introduced and strengthened when they produce a variety of reports for the various modules they study at L4: • As part of Design and Practice module, they produce individual and team reports, engage with a personal tutor, maintain record of their meetings, produce a portfolio etc. • As part of the Programming for Engineers, they produce evidence of working on development environments (IDE) through a comprehensive logbook and case study. • As part of the Analog and Digital Electronics, they produce a digital logbook as an ePortfolio and experience the process of submission of their records digitally through VLE and receive individual feedback via the VLE. • As part of the Principles of Electrical Engineering module, students experience the workplace scenario where they are required to follow basic health and safety aspects related to working in places where death by electrocution is a hazard. They also maintain a hand-written record of their experience in the workshop while they progress through a set of time scheduled exercises. This helps them to put learning into practice in a timely and organised way whilst

		also recording data in a meaningful way and they are encouraged to pay attention to handle data for later retrieval.
High impact pedagogies	<u>Group-based learning experiences</u> 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 appropriate. Consideration should be given to how students are allocated to groups to foster experience of diverse perspectives and values.	The following modules, encourage and allow students to work in small groups of 2 to 3 in various settings, and experiencing various learning techniques be it peer learning, or communication and networking with their buddies and respect their diversity and individual perspectives: • Programming for Engineers • Analog and Digital Electronics • Principles of Electrical Engineering Some module leaders, form groups where students are forced to work with random classmates in certain assignments and they are given a free choice to form groups for certain tasks.
Inclusive teaching, learning and assessment	<u>Accessible materials, resources and activities</u> All course materials and resources, including course guides, PowerPoint presentations, handouts and material available from VLE (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.	All teaching and learning materials are available as soft copies on the VLE in an appropriate accessible format. Module leaders also encourage students to approach them should they need the material in a different format. An example is notes with larger fonts for partially visually impaired students and printed material provided to DDS students.
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	The modules at L4 employ a range of course work assessments, categorised into formative or summative assessments that are integral to the learning and progression of all students.

	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**.	Formative assessments are important in the early years of a student's journey on the course as this will provide an opportunity to quickly act on the formative feedback obtained and work to address weaknesses which then helps them to progressively gain better marks in the later part of that assessment and other assessments. Also, due to the nature of the subjects studied, sometimes summative assessment are more suitable as it takes time for students to develop their understanding of complex concepts and then fully put them into practice or use, in either a classroom exercise or a work-place related case study. In situations where summative assessments are undertaken, formative feedback forms part of the scheduled contact time/meetings between the students and member of academic staff. Feedback for summative assessments is generally provided to students within the recommended timeframe as per the school/university regulations, which is currently 2 weeks after submission. Summative assessments contribute with a lower weighting, to the final module mark. The weightings can range from 5 to 50% depending on the number and type of assessment components that form part of the course work for that specific module.
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 build student autonomy and are likely to encourage	Students on this course are required to undertake small-scale independent enquiry-based study and contribute to either their individual projects/task or to a group/team project that they are part of. The module Rail Industry-Professional Practice at L4 and Rail Engineering Team Design Project at L5, facilitates such aspects for students to experience as part of their individual and team tasks and also as part of the major design challenge that all students on the module undertake. The design challenge is more of a cross disciplinary nature and required groups to be constituted with students from different pathways which allows them to work as an interdisciplinary team and enjoy the diversity of the team and raise to the challenging academic aptitude required.

	creativity and problem-solving. Dissemination of student research outcomes, for example via posters, presentations and reports with peer review, should also be considered.	The Rail Engineering Team Design Project module at L5 also builds on the students experiences and competencies gained in their L4 study and facilitates the teams to work on an open-ended, academically challenging aspect within the students own discipline where they are required to work as a team to undertake research (both individually and as a team) and explore creative and innovative solutions. They are also then required to present their working formally to their peers and lecturers. They also experience writing of reflective reports and undertake peer review/assessments which are moderated by the academic in charge of the session/project/task/module. Students on this module also experience the use of disseminating their work and ideas, using a range of techniques like posters, presentations, sketches etc.
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.	Students are invited to talks by alumni and the industrial advisory panel members, who often share their experiences and current issues in the industry, through case studies or presentations, relevant to the courses and this will help develop the understanding of students where they are able to see how their classroom knowledge can be transformed to provide solutions to problems in workplace.
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	Due to the nature of the subject material, there will be little contribution based on cultural or social diversity among the students of the cohort. However, industry practices vary from country to country and since our student body is diverse and arrive from different countries, this then becomes contextual in their learning, for e.g.

	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.	electrical earthing and bonding techniques/arrangements are traditionally different in different countries and are also industry specific, so what is applicable to land-based equipment is not relevant to off-shore equipment etc.
Curricula informed by employer and industry needs	<u>Work-based learning</u> Opportunities for learning that is relevant to future employment that is 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 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.	Work-based learning is part of this course, and part-time students who currently work in related technical capacity will have the benefit of immediately putting their knowledge into practice. Assignments where possible are designed to be based on case studies, which are close to real world scenarios and guest talks often feed into these.
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	The course offers varying assessment aspects which supports students attempts to adopt ways of thinking and practising, which is underpinned by knowledge and skills gained, the formative feedback provided and the opportunities to put them into practice. Students also undertake a variety of presentation techniques; they are generally required to assimilate information while performing a task in the laboratory or during a group discussion and quickly note it down as a running commentary in a logbook for formal presentation. Further in their study, they are required to retrieve data from the

	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. These can be, project reports, presentations, posters, lab or field reports, journal or professional articles, white-papers, case reports, handbooks, or guides.	information recorded which enables them to experience their own strengths and weaknesses associated with their personal style of recording information.
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.	Most of the students on these rail courses are predominantly from Network Rail, however they work in teams on lab-based exercises, which are usual from L4 to L6, or on specific group tasks as part of the modules that contribute to the development of soft skills at L4/L5. This is further strengthened when they undertake an interdisciplinary Professional Practice module at L4 and Team Design Project module at L5 where the culmination of all the knowledge, skills, experiences, is expected to shape the outputs which requires strong inclusivity, communication and networking skills, to bring out the potential of each team member to the maximum benefit of the team.
Assessment for learning	<u>Variation of assessment</u> An inclusive approach to curriculum recognises diversity and seeks to create a learning environment that enables equal opportunities for learning for all students and does not give those	The diversity and entry qualifications of the cohorts are considered when setting assessment which are approved by external examiners and are overseen by academic quality review processes, both through LSBU's internal reviews as well as period review at times of accreditation by the professional body.

	with a particular prior qualification (e.g. A-level or BTEC) an advantage or disadvantage. A 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.	Variation to standard agreed assessments are possible but should be approved by the relevant external examiner and relevant professional body accrediting the course, the IET in this case.
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 students 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**.	This course provides opportunities and support to enable students to gain general employability skills that are complemented with the help from the university's employability office (such as career planning, Career fairs etc.). Specific employability skills (few listed here) that are directly relevant to the industry are also developed as part of the course: • In the programming or Autocad modules students are taught and trained to used CAD packages which are widely used in the industry and is an important competency to add to their CV. Students in this course are trained in working with PCB designs of electronic circuits as part of Design and Practice.

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 4	LEVEL 5
1 Supporting the development and recognition of skills through the personal tutor system.	All students are allocated a personal tutor– coordinated by the Senior Personal Tutor. Personal tutoring is embedded in the level 4 module, Design and Practice where students are given the opportunity to learn about the role of the personal tutor. Students can request or book a slot to see their personal tutors. Induction course, including: 1. Meeting with personal tutor 2. Use of library and learning resources (LIS) 3. Use of University IT facilities/Blackboard VLE 4. Study skills. 5. Access to University support facilities. 6. Induction to 'Don't Panic' – PDP for L4.	Induction for direct entry students. See Level 4
2 Supporting the development and recognition of skills in academic modules/modules.	Most modules have practical elements, and this requires keeping a laboratory log book for each module. This occurs across all levels of the course, but particular emphasis is placed on this aspect at L4 as logbooks provide a platform for further skills development such as report writing, dissertations and project management occurring at Levels 5, and 6. The following L4 modules have generic skills components, including keeping a laboratory logbook, team-working, planning and managing study: Mathematics, Design and Practice, Electronic principles, Electrical Circuit Analysis. In the core mathematics module practice is encouraged by continuous assessment and feedback (weekly) of tutorial logbooks. Enhanced Maths tutorials – additional support is provided for mathematics to improve basic skills for those students with diverse entry qualifications.	Following on from L4 students continue the practice of keeping logbooks but this is now complemented in technical modules at L5 by writing formal laboratory reports which requires other skills such as information retrieval and processing and IT skills. This aspect is featured in the following modules: Professional Practice L4, Team Design Project L5, and Rail Systems Engineering L5.

3 Supporting the development and recognition of skills through purpose-designed modules.	Design and Practice plus Professional Practice and Team Design Project – these modules aim to introduce and develop the skills needed by professional engineers to enable them to make use of their technical knowledge, in particular: • Develop students' technical communications, basic report writing and team-working skills• Develop students' skills in project planning and management• Develop students' confidence in undertaking self-managed practical projects. CV writing, evaluation and interview techniques	Professional Practice L4 and Team Design Project L5 prepares students for their role as professional engineers in a number of ways, including: • Detailed study of project planning and networking techniques• Planning and preparation for the major project at L6• Introduction to systems thinking

4 Supporting the development and recognition of skills through research projects and dissertation work.	A team project in Design and Practice concentrates on the processes necessary to produce and market an electronic product.	Mini-projects, assignments and dissertations are featured in a number modules at L5, and Team Design Project module specifically tasks a team of students to take a project from requirements through to design solution within their selected degree discipline.

5 Supporting the development and recognition of career management skills.	Students have an introduction to the engineering profession and professional bodies	Not Relevant for these students as apprentices are already in relevant employment.
6 Supporting the development and recognition of career management skills through work placements or work experience.	CDs make students aware of potential sandwich placements.	Not Relevant for these students as apprentices are already in relevant employment and the levy funding means they cannot take a year out for exchange programs.

7 Supporting the development of skills by recognising that they can be developed through extracurricular activities.	The Skills for Learning Centre gives talks to student cohorts to encourage individuals to join the University Student Ambassadors scheme and the Mentoring scheme in local schools. The university maintains a VLE module site Skills for Learning Online including information about professional bodies and this is open to all students throughout their course. Students are encouraged to start their own 'clubs' and laboratory facilities and specific notice-boards are made available for this.	Not Relevant for these students as apprentices are already in relevant employment and the levy funding means they cannot take a year out for exchange programs.
8 Supporting the development of the skills and attitudes as a basis for continuing professional development.	Students are encouraged to join the relevant professional body for the course. We run sessions where IET visits and gives talks to students about the impact for their careers of joining professional bodies. The division pays the IET membership for 5 years to all enrolled studetns.	See L4
9 Other approaches to personal development planning.		

10 The means by which self-reflection, evaluation and planned development is supported e.g. electronic or paper-based learning log or diary.	Students must keep a personal technical logbook for each module with a laboratory or computer workshop component. This is marked within two weeks of each submission and returned with comments and advice. At L4 this forms the basis of the majority of the coursework mark in technical modules.	See L4. The logbook may form part of the coursework in some modules, but this is supplemented by formal reports, mini-projects, and dissertations in most technical modules.

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: **Mapping of the Knowledge, Skills and Behaviours of the "Rail and Rail Systems Engineer apprenticeship standard" to the course modules on FdEng Rail and Rail Systems Engineering**

L5 RAIL & RAIL SYSTEMS ENGINEER

Degree Title: FdEng Rail and Rail Systems Engineering (Sginalling and Control)

		Mathematics for Engineering	Analog and Digital Electronics	Principles of Electrical Engineering	Programming for Engineers	Rai; Industry Professional Practice	Rail Project and Asset Management	Advanced Engineering Mathematics	Rail Systems Engineering	Rail Signalling Interface	Rail Electrical Systems and Operation	Rail Standards and Specifications	Rail Engineering Team Design Project	
		L4 Modules						L5 Modules						
Core Knowledge: Knowledge and understanding of	**Safe and Professional working practices** including rail specific legislation, regulation (e.g. Common Safety Method Risk Assessment(CSM RA)), industry procedures, safety and quality requirements, risk management and environmental impact of rail construction work and rail equipment. Aware of the need for compliance with corporate policies including sustainability, ethics, equality and diversity, and how to constructively challenge non-compliance.					✓	✓					✓	✓	
	The scientific, technical, engineering, mathematical and design principles and practices relating to their area of expertise in the context of how the railway works as an integrated, complex system, including an appreciation of all specialisms. Awareness of the application of rail standards and means of compliance, incl. documentation management.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	How to contribute effectively to the delivery of rail specific engineering solutions, applying project management principles, asset, risk and quality management and assurance systems, processes and techniques. Cognisant of new technological developments and innovation in rail and the impact on future operation of the railway.					✓	✓	✓	✓	✓	✓	✓	✓	
	How strategic decisions are made including financial planning, budget control, commercial impacts, contractual obligations, supply chain management and resource constraints within a railway / regulated industry.					✓	✓					✓	✓	
	Problem solving and continuous improvement tools / techniques in a railway context.	✓	✓	✓			✓	✓	✓	✓	✓		✓	
	How teams work effectively; supporting individuals/teams to contribute to high performance within a safety critical sector and understanding how the specialist rail areas link together and their dependencies.					✓	✓		✓	✓	✓		✓	
	How to attract, recruit, develop and retain people including organisational change theory and performance management techniques within the safety critical rail sector.					✓	✓						✓	
	Approaches to partner, stakeholder and supplier relationship management within the rail industry and collaborative working techniques including negotiation, influencing, and effective networking within a railway / regulated industry.					✓	✓						✓	
Core Skills: Will have the ability to:	**Keep themselves and others safe** by demonstrating safe working practices. Reinforce and comply with rail specific statutory regulations and organisational safety requirements, including competence and safe access to work locations. Undertake risk assessments and hazard reviews using awareness of railway as an integrated system.					✓	✓		✓	✓	✓		✓	
	Apply a range of technical skill sets within their area of expertise or discipline in order to support railway research, development, design, procurement, logistics, planning, delivery, quality assurance, inspection, testing, installation, commissioning, maintenance, life cycle management, decommissioning and environmental compliance.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Deliver Rail & Rail Systems Engineering solutions effectively including planning, resource allocation, and management and delivery to the required specification. Contribute to change and risk management processes including contingency arrangement. Works in a team or alone to analyse, interpret and evaluate data and present the results clearly and concisely.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Provide input to technical, business planning, finance and commercial meetings. Ability to deliver workplace presentations which may include complex rail technical data to small and medium size internal and external audiences which may include peers, direct reports, manager and clients.					✓	✓		✓	✓	✓	✓	✓	
	Use creative thinking and problem solving techniques to challenge rail and rail systems engineering assumptions, make new proposals and build on existing ideas. Use evidence-based approach for a safety critical sector; contributing to continuous improvement.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Lead and support single discipline teams. Able to work effectively and collaboratively, individually and as part of a team**.** Identifies appropriate mentorship / coaching required for oneself, and supports the development of others through mentoring and coaching. Able to manage organisational change and apply change management processes within a railway / regulated industry.					✓	✓		✓	✓	✓	✓	✓	
	Manage relationships with a range of stakeholders. Able to apply collaborative working techniques. Being aware of their actions and the impact they may have on others rail specialists, maintaining effective relationships with colleagues, clients, suppliers and the public.					✓	✓					✓	✓	
Behaviours: will demonstrate	**Communication and influencing skills,** choosing an appropriate means for the audience and the situation, checking for understanding and considering and building on ideas of others. Has regular communication with peers, direct reports, managers, and external stakeholders aligned to operating within a railway / regulated industry.		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	Behaviours are partially met in a number of modules where there is a group work which is often the case on most modules involving workshops/computer labs/team assigment/ peer marking and refelctive reports, but these are mainly developed at the workplace.
	Professionalism, dependability, determination, consistency, resilience, honesty and integrity. Accepts and exercises personal responsibility within a safety critical sector. Demonstrates respect for others and acts ethically at all times. Contributes to sustainable development. Is committed to the industry and its professional standards.					✓	✓						✓	
	A self-disciplined, self-motivated and motivational approach to work, managing time effectively to ensure levels of commitment are understood and delivered.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Safe working practice, without close supervision, to approved rail industry standards. Identifies and takes responsibility for own obligations for health, safety and welfare issues. Challenges, escalates and responds to unsafe practices.					✓	✓					✓	✓	
	Collaborative working, being aware of their actions and the impact they may have on others, maintaining effective relationships with rail colleagues, clients, suppliers and the public. Demonstrates effective team working, sets an example, and is fair, consistent and impartial. Shares knowledge openly.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	A focus on quality, promoting a culture of continuous improvement.					✓	✓		✓	✓	✓	✓	✓	
	Continuous Professional Development; receptive to giving and receiving constructive feedback, willing to learn new skills and learn from mistakes. Identifies, undertakes and records CPD necessary to maintain and enhance competence. Maintains and extends a sound theoretical approach to the application of technology in engineering practice**.** Stays abreast of the technological developments that can affect the rail industry.					✓	✓					✓	✓	
Specific Knowledge and Skills														
Signalling and Control Systems (Knowledge) - Will know and understand	1. The requirements, methods and techniques for safe routing, spacing and control of trains e.g. degraded mode, fixed block signalling, automatic train protection. Interface with track assets and bonding/connections							✓	✓	✓				
	2. Rules for the operational interfaces of the railway.								✓	✓				
Signalling and Control Systems (Skills) – Will have an ability to:	1. Apply rail signalling and control systems skills e.g. independence of design, alignment to an operating railway, close out of issue logs.							✓	✓					
	2. Produce rail signalling and control solutions for the railway industry based on known and defined concepts and principles and new and novel approaches.							✓	✓	✓				