Royal Holloway, University of London
Programme specification for an undergraduate award
BSc Physics (Four Year Programme with Foundation Year) (F30F)

Section 1 – Introduction to your programme

This programme specification is a formal document, which provides a summary of the main features of your programme and the learning outcomes that you might reasonably be expected to achieve and demonstrate if you take full advantage of the learning opportunities that are provided. Further information is contained in the College prospectus, and in various handbooks, all of which you will be able to access online. Alternatively, further information on the College's academic regulations and polices can be found here. Further information on the College's Admissions Policy can be found here.

The Foundation Year prepares you for university study by offering a rigorous introduction to university level study methods and skills transitioning from FHEQ level 3 to FHEQ level 4. It provides progressive structures in which you are able to gain ever-wider knowledge and understanding of approaches to scientific study and your chosen degree subject, together with embedded practice and study skills, leading towards increasingly discipline specific activities in the practical laboratories or individual project modules which facilitate greater levels of specialisation and individual choice. All modules are mandatory for the foundation year, but subject to good academic performance will allow transfer to other Engineering, Physical and Mathematical Science foundation years. The modules are to provide a strong foundation in mathematics, computing and practical skills to succeed in later years of the degree programme. The mathematics and physics taught modules are primarily assessed by examinations which will allow to practice key skills and exam techniques. The laboratory and project modules are assessed by lab-reports and project reports respectively.

For some programmes there is the option of part-time study (the foundation year is full time). In that case a stage may be spread over two years of study; in each part-time year you will follow courses to the value of 60 credits. Upon progressing to the first year of your degree programme, you will complete a core, discipline-specific, knowledge base in stage one and two. Stage three offers a wide range of optional courses for Single Honours students; for those taking Joint or Combined Honours, the compulsory spine extends into this stage. During your degree programme you will broaden your knowledge and understanding, and be able to develop appropriate skills in Physics enabling you to graduate ready for employment in industry.

Specifically, stage one gives a balanced foundation for progression, offers opportunities for students to select and move between degree programmes according to their interests and provides a foundation which serves students from a wide variety of educational backgrounds. The stage one curriculum aims:

1. to extend and develop classical physics covered at A-level, to bring you to a common level and to set your knowledge into an appropriate context;
2. to develop modern physics and establish it on a firm foundation, enabling you to experience the flavour of modern physics, without excessive technical detail;
3. to extend and develop the mathematics covered at A-level;
4. to start the programme of discipline-specific and transferable skills.

Stage two builds on this and applies the skills and knowledge acquired to specific subjects. The available courses complete the essential physics core consisting of classical and modern physics, emphasising Electromagnetism, Quantum Mechanics, and Classical and Statistical Thermodynamics. Skills are further developed and Physics specialists take courses in Mathematical Methods, Solid State Physics, Optics, and Atomic and Nuclear Physics. Other courses are available for the other programmes.

In stage three, you take a number of advanced courses including options depending on your degree programme and personal interests. An important component of the final year is a project, PH3110, which may be of an experimental, theoretical, computational or electronics nature. Some third year courses closely reflect the research interests of members of staff, who are active specialists in their fields.

While Royal Holloway keeps all the information made available under review, programmes and the availability of individual course units, especially optional course units are necessarily subject to change at any time, and you are therefore advised to seek confirmation of any factors which might affect your decision to follow a specific programme. In turn, Royal Holloway will inform you as soon as is practicable of any significant changes which might affect your studies.

The following is brief description for some of the most important terminology for understanding the content of this document:

Degree programme – Also referred to as 'degree course' or simply 'course', these terms refer to the qualification you will be awarded upon successful completion of your studies.
Course unit – Also referred to as 'module', this refers to the individual units you will study each year to complete your degree programme. Undergraduate degrees at Royal Holloway comprise course units to the value of 120 credits per year. On some degree programmes a certain number of optional course units must be passed for a particular degree title.

Section 2 – Programme details			
Date of specification update	May 2019	**Location of study**	Egham Campus
Programme award and title	BSc Physics	**Level of study**	Undergraduate
Programme code	3455	**UCAS code**	F30F
Year of entry	2019/20		
Awarding body	Royal Holloway, University of London		
Department or school	Department of Physics (School of Engineering, Physical and Mathematical Sciences)	**Other departments or schools involved in teaching the programme**	N/A
Mode(s) of attendance	Full-time or part-time	**Duration of the programme**	Four years
Accrediting Professional, Statutory or Regulatory Body requirement(s)	Institute of Physics (IOP) – successful completion of this programme partially meets the educational requirement for becoming a Chartered Physicist.		
Link to Coursefinder for further information:	https://www.royalholloway.ac.uk/studying-here/	**For queries on admissions:**	study@royalholloway.ac.uk.

Section 3 – Degree programme structure										
3.1 Mandatory course unit information **The following table summarises the mandatory modules which students must take in each year of study**										
Year	**Course code**	**Course title**	**Contact hours***	**Self-study hours**	**Written exams****	**Practical assessment****	**Coursework****	**Credits**	**FHEQ level**	**Course status (see below)**
0	FY1001	Global Perspectives and Academic Practice I	50	100	0	0	100%	15	3	MC
0	FY1002	Global Perspectives and Academic Practice II	50	100	0	0	100%	15	3	MC
0	FY1005	Foundation Maths 1	55	95	70%	0	30%	15	3	MNC
0	FY1006	Foundation Maths 2	55	95	70%	0	30%	15	3	MNC
0	FY1009	Foundation Programming	44	106	0	60%	40%	15	3	MC
0	FY1010	Foundation Physical Sciences	44	106	60%	0	40%	15	3	MC
0	PH1998	Foundation Practical Skills	30	120	0	0	100%	15	3	MC
0	PH1999	Foundation Individual Scientific Project	20	130	0	0	100%	15	3	MC
1	PH1110	Mathematics for Scientists 1	68	82	80%	0	20%	15	4	MNC
1	PH1120	Mathematics for Scientists 2	68	82	80%	0	20%	15	4	MNC
1	PH1140	Scientific Skills 1	71	79	0	6%	96%	15	4	MC
1	PH1150	Scientific Skills 2	72	78	0	2%	98%	15	4	MC
1	PH1320	Classical Mechanics	40	110	80%	0	20%	15	4	MC

1	PH1420	Fields and Waves	40	110	80%	0	20%	15	4	MC
1	PH1620	Classical Matter	40	110	80%	0	20%	15	4	MC
1	PH1920	Physics of the Universe	40	110	80%	0	20%	15	4	MC
2	PH2130	Mathematical Methods	61	89	80%	0	20%	15	5	MC
2	PH2150	Scientific Computing Skills	82	68	0	0	100%	15	5	MC
2	PH2210	Quantum Mechanics	50	100	90%	0	10%	15	5	MC
2	PH2250	Scientific Skills 3	56	94	90%	0	10%	15	5	MC
2	PH2310	Optics	38	112	90%	0	10%	15	5	MC
2	PH2420	Electromagnetism	38	112	90%	0	10%	15	5	MC
2	PH2610	Classical and Statistical Thermodynamics	38	112	70%	0	30%	15	5	MC
2	PH2710	The Solid State	38	112	90%	0	10%	15	5	MC
3	PH3010	Advanced Skills	56	94	0	15%	85%	15	6	MC
3	PH3110	Experimental/Theoretical Project	94	56	0	20%	80%	15	6	MC

This table sets out the most important information for the mandatory courses on your degree programme. These courses are central to achieving your learning outcomes, so they are compulsory, and all students on your degree programme will be required to take them. You will be automatically registered for these courses each year. Mandatory courses fall into two categories; 'condonable' or 'non-condonable'.

In the case of mandatory 'non-condonable' (MNC) courses, you must pass the course before you can proceed to the next year of your programme, or to successfully graduate with a particular degree title. In the case of mandatory 'condonable' (MC) courses, these must be taken but you can still progress or graduate even if you do not pass them. Please note that although Royal Holloway will keep changes to a minimum, changes to your degree programme may be made where reasonable and necessary due to unexpected events. For example; where requirements of relevant Professional, Statutory or Regulatory Bodies have changed and programme requirements must change accordingly, or where changes are deemed necessary on the basis of student feedback and/or the advice of external advisors, to enhance academic provision.

*Contact hours come in various different forms, and may take the form of time spent with a member of staff in a lecture or seminar with other students. Contact hours may also be laboratory or, studio-based sessions, project supervision with a member of staff, or discussion through a virtual learning environment (VLE). These contact hours may be with a lecturer or teaching assistant, but they may also be with a technician, or specialist support staff. On your Foundation Year you will also have regular meetings with your personal tutor and specialised skills classes taught by staff in the Library.

**The way in which each course on your degree programme is assessed will also vary, however, the assessments listed above are all 'summative', which means you will receive a mark for it which will count towards your overall mark for the course, and potentially your degree classification, depending on your year of study. On successful completion of the course you will gain the credits listed. 'Coursework' might typically include a written assignment, like an essay. Coursework might also include a report, dissertation or portfolio. 'Practical assessments' might include an oral assessment or presentation, or a demonstration of practical skills required for the particular course.

3.2 Optional course units

In addition to mandatory course units, there will be a number of optional course units available during the course of your degree. The following table lists a selection of optional course units that are likely to be available. However, not all may be available every year. Although Royal Holloway will keep changes to a minimum, new options may be offered or existing ones may be withdrawn. For example; where reasonable and necessary due to unexpected events, where requirements of relevant Professional, Statutory or Regulatory Bodies (PSRBs) have changed and programme requirements must change accordingly, or where changes are deemed necessary on the basis of student feedback and/or the advice of External Advisors, to enhance academic provision.There may be additional requirements around option selection, so it is important that this specification is read alongside your department's Student Handbook, which you can access via their webpage.

Year 0	Year 1	Year 2	Year 3
None	None	None	PH3040 Energy and Climate Science
			PH3130 Advanced Classical Physics
			PH3150 Further Mathematical Methods
			PH3160 Nonlinear Systems and Chaos
			PH3170 C++ and Object Oriented Programming
			PH3210 Quantum Theory
			PH3520 Particle Physics
			PH3710 Metals and Semiconductors
			PH3730 Superconductivity and Magnetism
			PH3810 Frontiers of Metrology
			PH3910 General Relativity and Cosmology
			PH3920 Stellar Astrophysics
			GL3510 Planetary Geology and Geophysics

3.3 Optional course unit requirements
In stage three, you must choose options to the value of 90 credits from the courses offered by the Department. In choosing options you may take no more than 30 credits of stage two (FHEQ level 5) courses in the third year. When choosing optional courses you must be sure to satisfy any prerequisites.

Section 4 - Progressing through each year of your degree programme

For further information on the progression and award requirements for your degree, please refer to Royal Holloway's Academic Regulations.

In order to progress from the Foundation Year to Year One you must pass all 120 credits. Opportunities for resits are detailed in Royal Holloway's Academic Regulations. There is flexibility within the Foundation Year for you to take your Individual Project in one of the other departments in the School of Engineering, Physical and Mathematical Sciences offering a Foundation Year. The degree programme you choose to take after progression is likely to depend on the individual project you select during the foundation year.

As part of your degree programme you may also be required to complete a course to develop your academic writing skills. This course does not carry credit but passing it is a requirement to progress to the next year of study.

Part-time study - a stage may be spread over two years of study; in each part-time year you will follow courses to the value of 60 credits. Please note that the Foundation Year is not available in part time mode.

Stage 1a
PH1110 Mathematics for Scientists 1 (MNC)
PH1120 Mathematics for Scientists 2 (MNC)
PH1320 Classical Mechanics
PH1920 Physics of the Universe

Stage 1b
PH1140 Scientific Skills 1
PH1150 Scientific Skills 2
PH1420 Fields and Waves
PH1620 Classical Matter

Stage 2a

PH2130 Mathematical Methods
PH2210 Quantum Mechanics
PH2510 Atomic and Nuclear Physics
PH2610 Classical & Statistical Thermodynamics

Stage 2b
PH2150 Scientific Computing Skills
PH2310 Optics
PH2420 Electromagnetism
PH2710 The Solid State

Stages 3a & b
PH3010 Advanced Skills
PH3110 Experimental or Theoretical Project

In stage 3 you must choose options to the value of 90 credits from the courses offered by the Department.
In choosing options you may take no more than 30 credits of stage two (FHEQ level 5) courses in the third year.
When choosing optional courses you must be sure to satisfy any prerequisites.

In Stage 3 students may choose, with advice, which courses they take in which years. This is largely a matter of personal choice, although a balance of courses between the first and second terms must be ensured.

Section 5 – Educational aims of the programme

The aims of this programme are:

For the Foundation Year:

- to develop the required skills in mathematical concepts and techniques and for you to apply these concepts to problems in Engineering, Computer Science, Maths and Physics, in preparation for level 4 study;
- to equip you with the basic experimental, programming or practical techniques required for scientific degrees;
- to start the process of independent project work in science with support of expert academics;
- to put in context scientific knowledge and developments into a wider context of history, society and globalisation.

Following on to aims for the BSc:

- to impart a secure knowledge of the fundamental elements of Physics;
- to nurture confidence in the use of appropriate mathematical techniques;
- to develop the skills and knowledge required for experimentation and/or theoretical modelling;
- to promote oral and written communication skills;
- to teach the effective use of information technology and computing facilities for the treatment and presentation of experimental data;
- to provide a sound awareness of safety procedures and environmental issues;
- to develop and strengthen problem solving abilities;
- to provide a firm foundation for postgraduate research and further study in the physical sciences or for entry into a wide range of both scientific and non-vocational careers.

Section 6 - Programme learning outcomes

In general terms, the programmes provide opportunities for students to develop and demonstrate the following learning outcomes. (*Categories – Knowledge and understanding (K), Skills and other attributes (S), and Transferable skills (*)*)

Foundation Year

1. knowledge of and ability to apply mathematics to scientific and computational problems (**K,S**);
2. working knowledge of a least one high level programming language (**K**);
3. understanding of applying fundamental physics concepts to simple problems (**S**).
4. start to take responsibility and developing the individual learning, communication and research skills (**S**).

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5. A broad knowledge of the inanimate physical universe to a level appropriate for a Bachelor's degree **(K);**
6. A sound knowledge of the fundamental concepts of Physics and how these may be applied to understand complex physical systems and address associated problems **(K);**
7. An understanding of the quantum and continuum descriptions of natural phenomena **(K);**
8. An appreciation of the microscopic and macroscopic structure of all the states (phases) of matter and their interactions with different forms of energy **(K);**
9. A knowledge and understanding of important physical laws and principles, and competence in the application of these principles to more diverse areas of physics and, where appropriate, to other disciplines **(K);**
10. A secure understanding of the experimental and/or theoretical techniques and diagnostic tools appropriate to the particular field of endeavour and an awareness of such techniques in other fields **(K);**
11. A critical approach to the gathering, collating, analysis and reporting of experimental data based on an understanding of errors and the limits of measurement **(K);**
12. An understanding of mathematical modelling and of the role of approximation **(K);**
13. Use appropriate mathematical and/or computational tools to formulate and tackle problems in physics and to model physical behaviour, making necessary approximations, thus comparing critically the results of calculations with those from experimental observation **(S);**
14. Use appropriate methods to analyse data and to evaluate the level of its uncertainty and to relate any conclusions to current theories of the physics involved **(S);**
15. Execute an experiment or investigation, analyse critically the results of it and draw valid conclusions including evaluation of the level of uncertainty in the results and comparison with expected outcomes, published results or theoretical predictions **(S);**
16. Plan, execute and report the results of an experiment or investigation in physics **(S);**
17. Communicate scientific information clearly and accurately with correct use of technical language **(S*);**
18. Use a range of laboratory apparatus competently and safely **(S);**
19. Read demanding textbooks, and other available literature, search databases and listen carefully and interact with colleagues to extract important information. Make use of appropriate IT packages/systems for the retrieval and analysis of this data **(S*);**
20. Manipulate numerical data, and present and interpret information graphically **(S*);**
21. Analyse complex information, manipulating precise and intricate ideas to construct logical arguments and then presenting them in a clear and concise manner **(S*).**

Section 7 - Teaching, learning and assessment
Teaching is mostly by means of lectures, seminars, laboratory practical classes and problem-solving sessions; the latter generally providing a forum for you, with the support of your instructors, to work through problem sets and applications in a smaller and more interactive setting. Learning is through participation in lectures and seminars, designated reading, completion of problem sets and guided independent study and research. You are expected to meet basic standards in information technology, for which training is provided by the College Computer Centre. Assessment of knowledge and understanding is mainly by formal, unseen written examination; coursework exercises, laboratory reports, oral and poster presentations and a Project dissertation are also assessed. A detailed mapping of the ways in which particular courses and modules achieve the programmes' learning outcomes may be found in the Department of Physics Student Handbook. Full details of the assessments for individual courses can be obtained from the Department.

Section 8 – Additional costs
£55
These estimated costs relate to studying this particular degree programme at Royal Holloway. General costs such as accommodation, food, books and other learning materials and printing etc., have not been included, but further information is available on our website.

Section 9 – Indicators of quality and standards	
QAA Framework for Higher Education Qualifications (FHEQ) Level	3-6
Your programme is designed in accordance with the FHEQ to ensure your qualification is awarded on the basis of nationally established standards of achievement, for both outcomes and attainment. The qualification descriptors within the FHEQ set out the generic outcomes and attributes expected for the award of individual qualifications. The qualification descriptors contained in the FHEQ exemplify the outcomes and attributes expected of learning that results in the award of higher education qualifications. These outcomes represent the integration of various learning experiences resulting from designated and coherent programmes of study.	
QAA Subject benchmark statement(s)	http://www.qaa.ac.uk/quality-code/subject-benchmark-statements
Subject benchmark statements provide a means for the academic community to describe the nature and characteristics of programmes in a specific subject or subject area. They also represent general expectations about standards for the award of qualifications at a given level in terms of the attributes and capabilities that those possessing qualifications should have demonstrated.	

Section 10 – Further information
This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate when taking full advantage of the learning opportunities that are available. More detailed information on course units, including teaching and learning methods, and methods of assessment, can be found via the online Course Catalogue. The accuracy of the information contained in this document is reviewed regularly by the university, and may also be checked routinely by external agencies, such as the Quality Assurance Agency (QAA). Your programme will be reviewed regularly, both by the university as part of its cyclical quality enhancement processes, and/or by your department or school, who may wish to make improvements to the curriculum, or in response to resource planning. As such, your programme may be revised during the course of your study at Royal Holloway. However, your department or school will take reasonable steps to consult with students via appropriate channels when considering changes. All continuing students will be routinely informed of any significant changes. In line with the College's Admissions Policy, if your department make any significant changes to any year of your programme of study between the time at which an offer is made to you on the Foundation Year and the point at which you complete your registration we will write to you advising you of the changes and the rationale.

Section 11 – Intermediate exit awards (where available)		
You may be eligible for an intermediate exit award if you complete part of the programme as detailed in this document. Any additional criteria (e.g. mandatory course units, credit requirements) for intermediate awards is outlined in the sections below.		
Award	**Criteria**	**Awarding body**
Diploma in Higher Education (DipHE)	Pass in 210 credits of which at least 90 must be at or above FHEQ Level 4 and at least 120 of which must be at or above FHEQ Level 5	Royal Holloway and Bedford New College
Certificate in Higher Education (CertHE)	Pass in 120 credits of which at least 90 must be at or above FHEQ Level 4	Royal Holloway and Bedford New College

Section 12 - Associated award(s)
BSc Physics (F300) MSci Physics (F303)