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| 4001PHASCI  Semester 1  *Pharmaceutical science* | PHYSICAL PHARMACEUTICS  (20c) | *Aim:*  To introduce the basic principles of physical chemistry as they relate to the formulation of drug products | *Learning activities:*  Lectures  Practicals – Phase diagram, drug stability, phase separation and surface tension  Workshops – Drug properties | *Assessment:*  Lab report on drug stability (40%) Final exam (60%) |
| 4003PHASCI  Semester 1  *Pharmaceutical science* | PRINCIPLES OF HUMAN BIOLOGY  (20c) | *Aim:*  To explore principles of human physiology and pathology with respect to homeostatic mechanisms. To demonstrate an understanding of bacteria, viruses and fungus and their role in human health and disease. | *Learning activities:*  Lectures covering each topic within the module (26 hours of lectures)  Practical laboratory class in microbiology techniques. Includes a 3 hour introductory session on GLP and correct use of equipment (formative assessment). Subsequent summative assessment is 12 hours of microbiology laboratory work and submission of laboratory report (15 hours in total).  A formatively assessed poster presentation around current topics in the field of microbiology (antibiotic resistance, Zika virus or the gut microbiome and human disease) (2 hours)  Workshops - 16 hours in total - formative (2 hours of workshops per topic) with oral feedback given during formative sessions.  Topics for workshops include -  • Classification of microorganisms  • Morphology and staining of pharmaceutically important bacteria, fungi etc.  • PBL Immunology - Autoimmune disease and treatment case study  • PBL - Haemostasis  • Endocrinology - 'dry lab'. Principles of Negative feedback  • Poster presentation preparation and Q and A session (2 sessions)  • Microbiology laboratory support workshops  Lecture material is supported and self-assessed by formative, online Blackboard tests (2 x 1 hour per semester, from a bank of questions) | *Assessment:*  Laboratory report (40%) Examination (60%) |
| 5003PHASCI  Semester 1  *Pharmaceutical science* | PRINCIPLES OF PHARMACOLOGY  (20c) | *Aim:*  The module aims to build upon homeostatic principles established at Level 4, developing knowledge of anatomical, physiological and pharmacological organisation of biological systems (respiratory, gastrointestinal, cardiovascular, hepatic and renal). It supports an understanding of therapeutic modes of drug action, and the pharmacokinetic determinants of dosing. It introduces examples of the formulations used to deliver drugs and the bases for their toxicity, concepts that are advanced in associated modules at L5 and 6. | *Learning activities:*  Lectures: Deliver outline of the anatomical, physiological and pharmacological organisation of biological systems (respiratory, gastrointestinal, cardiovascular, hepatic and renal) in normal and diseased states; and the basis for the use of therapeutic drug classes applied to disorders.  Practicals: Demonstrate physiological and diagnostic principles (respiratory and cardiovascular); pharmacolodynamic principles (gastrointestinal and cardiovascular organ bioassay) and pharmacokinetic dose regimen calculations.  Tutorials and workshops: Provide formative exercise at interpreting and reporting pharmacological evidence and pharmaceutical calculations. | *Assessment:*  Exam (60%) Portfolio of Lab reports (40%) |
| 5004PHASCI  Semester 1  *Pharmaceutical science* | STERILE PHARMACEUTICAL PRODUCTS  (20c) | *Aim:*  To describe and evaluate the formulation, preparation, manufacture and quality control of sterile products including injections and ophthalmic products.  To describe and discuss the principles and practice of sterilisation and sterilisation controls.  To discuss the concepts of quality assurance of sterile products  To facilitate the development of communication skills (written) as they apply to the content of the module. | *Learning activities:*  • Lectures covering each topic within the module  • Practical sessions giving students first-hand experience of relevant formulation principles and sterilisation processes and practical: group project to formulate and evaluate an assigned pharmaceutical sterile product  • Workshops to support sterilisation process, formulation of sterile products and relevant quality control methods  • Tutorial to support practical group work  • Heat resistance of microorganisms (thermal death point, thermal death time, D-values, Z-values, Fo-values).  • Sterilisation processes, including theory and practice, methods, validation and design of sterilisers for: Autoclaving, Dry heat sterilisation, Ionising radiation, Filtration, and Gaseous sterilisation.  • The concepts of bioburden, overkill and depyrogenation  • Physical, biological and chemical controls of sterilisation including sterility tests  • Aseptic processes, principles and evaluation of clean rooms and isolation units  • Cleaning and disinfection of clean manufacture and aseptic areas, including disciplines expected of personnel working in such areas  • Formulation, preparation and production of the following sterile products: Ophthalmic products (eye ointments, eye drops, eye lotions, contact lens solutions), Parenteral products (injections, total parenteral nutritional fluids), Water for injections, Bladder irrigations, and Dialysis solutions | *Assessment:*  Sterile Dosage Forms (40%) Exam (60%) |
| 6002PHASCI  Semester 1  *Pharmaceutical science* | ADVANCED PHARMACEUTICAL ANALYSIS  (20c) | *Aim:*  To develop knowledge and practical experience of advanced techniques available for the analysis of pharmaceutical products. | *Learning activities:*  Lectures covering each topic within the module  Practical sessions giving students first-hand experience of relevant analytical techniques  Workshops to support data interpretation and lecture material | *Assessment:*  Practical Report (40%) Exam (60%) |
| 6003PHASCI  Semester 1  *Pharmaceutical science* | ADVANCED DELIVERY SYSTEMS  (20c) | *Aim:*  To present and illustrate methods for the formulation and application of advanced drug delivery systems. | *Learning activities:*  Lectures covering the different topics within the module  Practical sessions giving students first-hand experience of relevant formulation principles  Workshops to support each of the topics, literature review, experimental design and analysis of data generated during practical sessions | *Assessment:*  Practical Report (40%) exam (60%) |
| 7101PHASCI  Semester 1  *Pharmaceutical science* | RESEARCH METHODS  (20c) | *Aim:*  To equip students with the necessary core skills to effectively design, plan, perform and report scientific research. | *Learning activities:*  Lectures (flipped or traditional) introducing/covering the various topics of the module  Workshops –various contents aligned with topics delivered in the lectures  Directed study and guided study activities on VLE | *Assessment:*  Research Proposal and pitch (60%) Data appraisal portfolio (40%) |
| 7102PHASCI  Semester 1  *Pharmaceutical science* | ANALYSIS, STRUCTURE AND FUNCTION IN ORGANIC MOLECULES  (20c) | *Aim:*  To understand the application of analytical chemistry to pharmaceutical materials, and the effect of functional group chemistry on both the structure and consequent properties of relevant molecules. | *Learning activities:*  Lectures introducing each topic within the module.  Practical sessions giving students hands-on experience of relevant analytical techniques.  Workshops to support both the analysis of data generated during practical sessions and problem-solving skills relevant to molecular structure and function. | *Assessment:*  Practical Skills (40%) Exam (60%) |
| 7103PHASCI  Semester 1  *Pharmaceutical science* | PHYSICOCHEMICAL PROPERTIES OF THERAPEUTIC AGENTS  (20c) | *Aim:*  To understand the physical and chemical properties of both small molecules and macromolecules and how these influence their in vitro and in vivo behaviour as active pharmaceutical ingredients. | *Learning activities:*  Lectures introducing each topic within the module  Practical sessions giving students first-hand experience of relevant techniques  Workshops to support analysis of data generated during practical sessions | *Assessment:*  Examination (60%) Practical Report (40%) |
| 7111PHASCI  Semester 1  *Pharmaceutical science* | PHYSIOLOGY AND TOXICOLOGY  (20c) | *Aim:*  To enable students to describe key physiological processes and how these may be perturbed by exogenous chemicals to elicit a toxicological response. | *Learning activities:*  Flipped and/or traditional lectures to introduce /cover the topics outlined in the syllabus.  Workshops to assist students in locating, evaluating and interpreting in vivo, in vitro and in chemico data. The workshops will be focused on fulfilling the requirements of the coursework exercise.  Practical activity will typically relate to assessing potential exposure, measuring toxicity and investigating chemical potential to ameliorate toxicity (e.g. in vivo investigation of dermal exposure and interaction with skin, in vitro toxicity (MTT) assay, determination of anti-oxidant activity.) | *Assessment:*  Examination (50%) Data analysis (50%) |
| 7112PHASCI  Semester 1  *Pharmaceutical science* | FORMULATION AND CHARACTERISATION OF COSMETICS  (20c) | *Aim:*  To equip students with the knowledge, understanding and application of raw materials and cosmetic formulations. | *Learning activities:*  Lectures - introducing /covering the various topics of the module  workshops – problem solving in terms of cosmetic formulations and raw materials  Laboratory Practicals – Provide students first-hand experience of preparing and testing cosmetic formulations | *Assessment:*  Examination (50%) Laboratory Practical & Report (50%) |
| 7116PHASCI  Semester 1  *Pharmaceutical science* | COMPUTATIONAL APPROACHES AT THE CHEMICAL-BIOLOGICAL INTERFACE  (20c) | *Aim:*  To introduce students to the building blocks of biological systems (key molecules, organelles and cells), the nature of chemicals (classes/chemical space), structures and properties and how computational approaches are being used to solve contemporary problems at the interface between chemistry and biology. | *Learning activities:*  Flipped and/or traditional lectures to introduce/cover the topics outlined in the syllabus  Workshops aligned with the biology/chemistry syllabus to provide examples or further investigation of key molecules and their features. Practical activity in computer suite using software to obtain and/or predict properties. | *Assessment:*  Essay and narrated slides (50%) Exam (50%) |
| 4004PHASCI  Semester 2  *Pharmaceutical science* | FORMULATION SCIENCE  (20c) | *Aim:*  To understand the physicochemical properties of active pharmaceutical ingredients and to introduce the basic principles of pharmaceutical formulation | *Learning activities:*  Lectures to cover fundamental theory and concepts.  Laboratory-based practicals to apply principles and provide first-hand experience of techniques.  Workshops to support group work for coursework assessment, problem-based learning activities and revision of topics. | *Assessment:*  Coursework (40%) Exam (60%) |
| 4005PHASCI  Semester 2  *Pharmaceutical science* | ANALYTICAL CHEMISTRY  (20c) | *Aim:*  The module aim is to provide a basic, practical and relevant mathematical and analytical chemistry foundation for the quantitative aspects all Pharmaceutical Science Level 4 modules. | *Learning activities:*  1. Lectures: Lectures will be delivered covering the topics of the philosophy of science, statistics and data analysis, quantitative and qualitative chemistry, and analytical chemistry.  2. Practicals: Basic spectroscopic techniques (UV), thin-layer chromatography, titrimetry, colour tests.  3. Tutorials and workshops : Pharmaceutical calculations, data manipulation, and spectroscopy. | *Assessment:*  Practical report (40%) Examination (60%) |
| 4006PHASCI  Semester 2  *Pharmaceutical science* | BIOLOGICALLY ACTIVE MOLECULES  (20c) | *Aim:*  To emphasise those chemical properties which are significant with respect to the involvement of drugs in biochemical transformations. To develop an ability to gather, evaluate and communicate scientific information. To facilitate the application of information presented in this module to the solution of problems. | *Learning activities:*  Lectures covering each topic within the module  Directed reading associated with each module topic  Practical sessions (4x3hr) giving students first-hand experience of relevant enzyme and protein bioassays; practical briefing lecture (2x1hr)  Problem solving workshops to support literature review, experimental design and analysis of data generated during practical sessions (8 x 2hr)  Formative mid-semester Blackboard MCQ test (2hr) | *Assessment:*  Practical Reports (40%) Exam (60%) |
| 5001PHASCI  Semester 2  *Pharmaceutical science* | PHARMACEUTICAL FORMULATION  (20c) | *Aim:*  Knowledge, understanding and application of the formulation of dosage forms; including the solid oral dosage forms of tablets and capsules, pulmonary, nasal, transdermal, vaginal, rectal, semi-solid, controlled release oral drug delivery systems. Introduction to micro- and nanocarrier delivery systems | *Learning activities:*  Lectures covering each topic within the module  Practical sessions related to powder flow, capsules, pulmonary dosage forms and tablet formulation, manufacture and testing  Revision workshop to support the lecture material and practical sessions | *Assessment:*  Laboratory Tablets Report (40%) Exam (60%) |
| 5005PHASCI  Semester 2  *Pharmaceutical science* | PHARMACEUTICAL ANALYSIS  (20c) | *Aim:*  To develop knowledge, practical experience and the interpretation skills necessary for the quantitative and qualitative analysis of chemical species relevant to the pharmaceutical industry. | *Learning activities:*  Lectures covering each topic within the module  Practical sessions giving students first-hand experience of relevant analytical techniques and their application pharmaceutical analysis  Workshops to support practical sessions and to consider the mathematical manipulation of data and their interpretation | *Assessment:*  Examination (60%) Practical report (40%) |
| 5006PHASCI  Semester 2  *Pharmaceutical science* | INTEGRATED APPROACHES TO THERAPEUTICS  (20c) | *Aim:*  To understand how the underpinning pharmaceutical science disciplines can be applied in an integrated way to develop good therapeutic strategies for treating diseases. | *Learning activities:*  Lectures  Workshops  Tutorials  Self-directed independent study | *Assessment:*  Exam (60%) Critical evaluation essay (40%) |
| 6001PHASCI  Semester 2  *Pharmaceutical science* | INDUSTRIAL DRUG DEVELOPMENT  (20c) | *Aim:*  To present information relating to pharmaceutical manufacturing processes and the associated regulatory controls to ensure consistency of patient safety. | *Learning activities:*  Lectures covering each topic within the module (e.g. 6 topic groupings comprising 30 lectures).  A workshop to support the understanding of ICH guidelines and related implications.  Visits to pharmaceutical manufacturing sites in the locality to consolidate taught material. | *Assessment:*  Exam (60%) Presentation (40%) |
| 6004PHASCI  Semester 2  *Pharmaceutical science* | CLINICAL DRUG DEVELOPMENT  (20c) | *Aim:*  Upon completion of this module, students should be able to demonstrate an awareness and understanding of preclinical testing and management and regulation of clinical trials in the process of drug development. In addition, students should be able to discuss the challenges and ethical issues in patient recruitment and retention and the importance of publication of clinical trial data. | *Learning activities:*  Workshops apply knowledge and demonstrate understanding of lecture material and further reading;  Formative feedback will be given within the sessions.  Examples can include:  • Case record form Design  • Protocol development  • SOPs - students to design an SOP  • Clinical trial documentation - Documenting and Reporting Clinical Trials – discussion of the essential statistical requirements when documenting and reporting clinical trials.  • Clinical Trial Analysis and Reporting. Statistics - Estimation and Confidence Intervals – measuring the magnitude of a treatment effect and the concept of confidence interval calculation  • The Challenges in Patient recruitment and retention  • The Ethical issues in outsourcing to LEDs (lower economically developed countries).  • Essay writing skills - in preparation for the coursework.  An Essay on Ethical implications of Outsourcing (Summative)  End of module examination (Summative) (50% MCQ and 3 SAQ)  Online MCQ quizzes (formative) | *Assessment:*  Final exam (60%) Essay (40%) |
| 7104PHASCI  Semester 2  *Pharmaceutical science* | MEDICINAL CHEMISTRY  (30c) | *Aim:*  To understand the application of medicinal chemistry to the drug discovery process and the requirement for a modern synthetic approach to the supply of relevant molecules | *Learning activities:*  Lectures with on-line pre-work  Problem solving workshops to build on each lecture  Practical sessions themed to build up a mini-project | *Assessment:*  Exam (60%) Mini-project (practicals) (40%) |
| 7105PHASCI  Semester 2  *Pharmaceutical science* | NATURAL PRODUCTS  (30c) | *Aim:*  To understand various aspects of chromatographic, spectroscopic and assay techniques and approaches pertinent to natural products drug discovery, and the chemistry of natural products | *Learning activities:*  Lectures to introduce each topic within the module  Practical sessions to give students first-hand experience of relevant techniques  Workshops to support analysis of spectroscopic data to elucidate structure of various classes of natural products | *Assessment:*  Lab report (40%) Examination (60%) |
| 7106PHASCI  Semester 2  *Pharmaceutical science* | FORMULATION AND DRUG DELIVERY  (30c) | *Aim:*  To provide students with knowledge and skills to master the principles of pharmaceutical formulation and advanced drug delivery methods. | *Learning activities:*  Lectures covering each topic within the module  Practical sessions giving students first-hand experience of relevant formulation principles  Workshops to support reviews of current literature, experimental design and analysis of data generated during practical sessions | *Assessment:*  Mini project (40%) exam (60%) |
| 7107PHASCI  Semester 2  *Pharmaceutical science* | PRODUCT DEVELOPMENT AND CONTROL  (30c) | *Aim:*  To understand and apply the principles of good manufacturing practice to the production and quality control of pharmaceutical products | *Learning activities:*  Lectures covering each topic within the module  Practical sessions giving students first-hand experience of relevant manufacturing techniques  Performing laboratory based activitoes plus writing reports, which inlcudes data analysis  Workshops on ICH guidelines and their application in practice and to support analysis of data generated during practical sessions | *Assessment:*  Examination (60%) Report (40%) |
| 7113PHASCI  Semester 2  *Pharmaceutical science* | MANUFACTURE OF COSMETICS  (20c) | *Aim:*  To equip students with the Knowledge and understanding of large scale-up for manufacturing and packaging attributes of relevance to cosmetic formulations. In addition students will acquire the knowledge, understanding and application of microbiological testing | *Learning activities:*  Lectures - introducing /covering the various topics of the module  workshops – problem solving in terms of cosmetic formulation claims, packaging and labelling  Laboratory Practical's – Provide students first-hand experience of microbial testing and analysis | *Assessment:*  Report on cosmetic manufacture (50%) Examination (50%) |
| 7114PHASCI  Semester 2  *Pharmaceutical science* | SAFETY-BASED DECISION MAKING  (20c) | *Aim:*  To equip students with detailed knowledge and understanding of the regulatory framework covering chemical toxicity prediction in the UK, EU and worldwide.  To introduce the risk assessment process in industry and explain the role of the different organisations involved in the process.  Students will gain knowledge of how weight of evidence can be used to combine a wide range of data sources to aid chemical toxicity prediction, without the use of animals, and how these approaches are used in industry to make decisions concerning the safety assessment. | *Learning activities:*  Lectures (flipped or traditional) introducing/covering the topics identified in the module syllabus.  Workshops – extensive use will be made of workshops to demonstrate (computational) resources that are aligned with the topics delivered in the lectures and required for completion of the coursework exercise. | *Assessment:*  Oral presentation (50%) Examination (50%) |
| 7115PHASCI  Semester 2  *Pharmaceutical science* | BUSINESS PLANNING FOR COSMETIC SCIENCE  (20c) | *Aim:*  To enable students to analyse and identify a commercially viable cosmetic product and produce a business plan to enable the product to be launched | *Learning activities:*  Lectures - introducing /covering the various topics of the module  Workshops and academic support – development of a business idea and plan  Presentation – Dragons Den format of student pitching their potential product idea | *Assessment:*  Oral presentation (40%) Written business plan (60%) |
| 7117PHASCI  Semester 2  *Pharmaceutical science* | COMPUTATIONAL METHODS IN TOXICOLOGY I: DATA AND MODELLING  (20c) | *Aim:*  To enable students to create and curate chemical datasets, using appropriate quality assessment checks and to use such a dataset to build elementary structure-activity relationship models, cognisant of the principles of good modelling practice. | *Learning activities:*  Flipped and/or traditional lectures to introduce/cover the topics outlined in the syllabus.  Workshops and hands-on computer-based activities to provide experience of using a wide range of computational methods, particularly in relation to building chemical datasets, developing structural alerts and acquiring data to assist read-across. | *Assessment:*  Report Strutural Alerts (50%) Exam (50%) |
| 7118PHASCI  Semester 2  *Pharmaceutical science* | COMPUTATIONAL METHODS IN TOXICOLOGY II: ADVANCED PREDICTIVE METHODS  (20c) | *Aim:*  To enable students to compare the advantages, disadvantages and applications of advanced computational modelling approaches, considering metrics such as adherence to OECD principles, applicability domain, reproducibility, transparency and statistical performance. To equip students with the skills necessary to build, optimise, interpret and report quantitative structure-activity relationship models. | *Learning activities:*  Flipped and/or traditional lectures to introduce/cover the topics outlined in the syllabus.  Workshops and hands-on computer-based activities to provide experience of using a wide range of computational methods, particularly in relation to building, optimising and evaluating quantitative structure-activity relationship models and demonstrating the utility of pipeline environments for model building. | *Assessment:*  Portfolio QSAR model (50%) Exam (50%) |
| 6000PHASCI  Yearlong  *Pharmaceutical science* | RESEARCH METHODS AND PROJECT  (40c) | *Aim:*  The aim of the module is to enable students to plan, execute and report results of a research project in the area of pharmaceutical sciences, using a range of appropriate resources and methodology. | *Learning activities:*  Students will undertake a series of lectures, workshops and tutorials to help prepare for and execute their final year projects. The majority of time for this module will be devoted to the practical work undertaken for the final year research project. Students will present their research in a final seminar session. | *Assessment:*  Project Report (65%) Portfolio (35%) |